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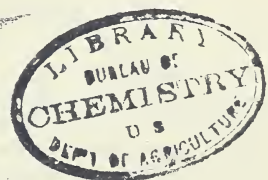
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ANNUAL REPORTS  
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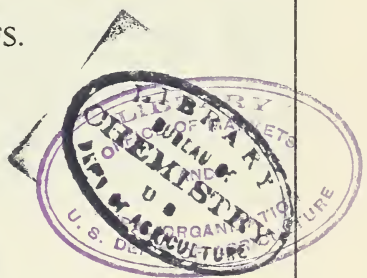
FOR THE YEAR ENDED JUNE 30,

1915.



REPORT OF THE  
SECRETARY OF AGRICULTURE.

REPORTS OF CHIEFS.



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1916.

[CHAPTER 23, Stat. L., 1895.]

[AN ACT Providing for the public printing and binding and the distribution of public documents.]

\* \* \* \* \*

Section 73, paragraph 2:

The Annual Report of the Secretary of Agriculture shall hereafter be submitted and printed in two parts, as follows: Part One, which shall contain purely business and executive matter which it is necessary for the Secretary to submit to the President and Congress; Part Two, which shall contain such reports from the different Bureaus and Divisions, and such papers prepared by their special agents, accompanied by suitable illustrations, as shall, in the opinion of the Secretary, be specially suited to interest and instruct the farmers of the country, and to include a general report of the operations of the Department for their information. There shall be printed of Part One, one thousand copies for the Senate, two thousand copies for the House, and three thousand copies for the Department of Agriculture; and of Part Two, one hundred and ten thousand copies for the use of the Senate, three hundred and sixty thousand copies for the use of the House of Representatives, and thirty thousand copies for the use of the Department of Agriculture, the illustrations for the same to be executed under the supervision of the Public Printer, in accordance with directions of the Joint Committee on Printing, said illustrations to be subject to the approval of the Secretary of Agriculture; and the title of each of the said parts shall be such as to show that such part is complete in itself.



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REPORT OF THE SECRETARY OF AGRICULTURE.

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## REPORT OF THE SECRETARY OF AGRICULTURE.

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WASHINGTON, D. C., *November 13, 1915.*

SIR: In spite of the greatly disturbed condition of the world during the last 15 months, agriculture in the United States, as a whole, has prospered. In some sections the war raging in Europe has caused severe hardships and great financial loss, while in other sections its first result at least has been very considerable financial gain. It has borne very heavily on the southern cotton farmer, forcing a great reduction in the price of cotton and an attempt at a hasty readjustment. It has operated to stimulate the production of food-stuffs, and to producers of such commodities it has, in the main, brought increased prices.

The outbreak of the war found this country in a peculiarly fortunate agricultural situation. The year 1914 witnessed an unusually large production of a number of staple crops. The wheat crop of 891,000,000 bushels established the Nation's record and was 128,000,000 bushels larger than that of any other year. The corn crop of 2,673,000,000 bushels, while it was only an average one, exceeded that of 1913 by 226,000,000 bushels. The oats crop of 1,141,000,000 bushels was the third largest on record. The potato crop of 406,000,000 bushels was 74,000,000 bushels larger than that of the preceding year and the second in size in the history of the Nation. The barley crop of 195,000,000 bushels was nearly 17,000,000 bushels greater than that of 1913 and the second largest on record. The tobacco crop of 1,035,000,000 pounds was exceeded only by those of 1909 and 1910. The hay crop of 70,071,000 tons was the third in size, and the cotton crop of 16,135,000 bales exceeded the next largest, that of 1911, by 442,000 bales. The total estimated value of all farm crops and animal products for the year is \$9,873,000,000, an amount greater by \$83,000,000 than the next largest crop value, that of 1913, notwithstanding the great decrease in the price of cotton.

## AGRICULTURAL EXPORTS.

The abundant supplies of foodstuffs made it possible for the country to meet the greatly increased foreign demand and still to retain enough at home to satisfy the normal domestic needs. It was fortunate for our financial relations that these enormous crops coincided with the breaking out of the war. Last fall the question seriously was raised as to how this Nation could discharge to European creditors its floating obligations, amounting at the time, according to the best estimates, to about \$400,000,000. It was expected that the exportation of manufactures would decrease, and it was not known that there would be available for export and would be exported such a volume of agricultural commodities. As a matter of fact, between August 1, 1914, and February 1, 1915, the exports were \$1,157,000,000 and the imports \$771,000,000, giving a favorable balance of \$386,000,000. Of the total volume of exports, \$662,000,000 represented agricultural and only \$495,000,000 nonagricultural commodities, chiefly manufactures. In the same period for the preceding year there were exported \$638,000,000 worth of nonagricultural and \$722,000,000 of agricultural products, of which cotton alone represented 55 per cent, or \$407,000,000, and all other agricultural commodities, chiefly foodstuffs, only \$315,000,000. On the other hand, from August 1, 1914, to February 1, 1915, the cotton exports were only \$168,000,000 and other agricultural products, mainly foodstuffs, \$494,000,000.

The total agricultural exports in the fiscal year ended June 30, 1915, practically the first year of the war, were \$1,470,000,000, which is an increase of \$356,000,000, or 32 per cent, over those of the preceding year, and of \$433,000,000, or nearly 42 per cent, over the average of the five years 1910-1914.

A comparison of exports of the year with those of the preceding year shows that the exports of horses and mules increased from \$4,000,000 to \$77,000,000, meats and dairy products from \$146,000,000 to \$220,000,000, wheat (and wheat flour) from \$142,000,000 to \$428,000,000, corn (and cornmeal) from \$7,000,000 to \$39,000,000, oats from \$1,000,000 to \$57,000,000, and barley from \$4,000,000 to \$18,000,000, while cotton decreased from \$610,000,000 to \$376,000,000 and tobacco from \$54,000,000 to \$44,000,000. These products comprise nearly nine-tenths of the total agricultural exports.

A great gain is shown here in the exports of horses and mules. Usually the number of horses and mules exported is insignificant. The total for the year (355,000) represents little more than 1 per cent of the supply in the United States, and was not sufficient to prevent a decline of about 4.6 per cent in the average price.

By far the greatest gain in American agriculture in the first year of the war arose from increased demand for grain. The exports of wheat (and wheat flour) represented about 37 per cent of the crop of 1914, the usual exportation being less than 20 per cent. Farmers received an average of 79 cents a bushel for the 1913 crop and \$1.01 for that of 1914—an increase of 22 cents a bushel or an aggregate gain of approximately \$196,000,000.

The exports of corn, oats, and barley greatly increased, but, as they were only a small part of the total production, the direct influence on prices was comparatively small. The exports of corn (and cornmeal), 51,000,000 bushels, were less than 2 per cent of the total yield (2,673,000,000 bushels); but, as the crop of 1914 was 226,000,000 bushels larger than that of the preceding year, the exports did not absorb one-fourth of the surplus, and the average price received by farmers was slightly less than that for the 1913 crop. Exports of oats increased from 2,000,000 to 97,000,000 bushels, about 8 per cent of the crop, enough to have some influence on prices. The average price per bushel to farmers was 30 cents, compared with 29 cents the preceding year. Exports of barley, 27,000,000 bushels, were nearly 14 per cent of the crop, sufficient to have material influence on prices; so that, while the production was nearly 10 per cent larger than that of 1913, prices averaged 2 cents higher per bushel.

Although the exports of meats and dairy products rose from \$146,000,000 to \$220,000,000, or about one-half, they did not prevent a decline in prices to producers of cattle and hogs, possibly because of a still greater increase in available supplies during the year.

#### THE COTTON SITUATION.

The greatest adverse effect of the disturbance was on cotton marketing. The reason for this may be seen from a few comparisons. Under normal conditions we export more than 65 per cent of the cotton crop, 40 per cent of the tobacco crop, 15 per cent of wheat, 4 per cent of barley, less than 2 per cent of corn, and less than 1 per cent of oats. Or, making the comparison with our total agri-



cultural exports, cotton constitutes approximately 53 per cent of the whole; cottonseed products, 3 per cent; meats and other packing-house products, 15 per cent; wheat (and wheat flour), 10 per cent; tobacco, 4 per cent; corn, oats, and barley combined, about 3 per cent; all others, 12 per cent.

Soon after the outbreak of the war the cotton market became demoralized from fear that exportation would be stopped or materially curtailed and from realization of the fact that the crop would be large. The price to farmers on August 1, 1914, was 12.4 cents per pound. By November 1 it had fallen to 6.3 cents per pound, a reduction of nearly one-half. The cotton crop of 1913 averaged to producers 12.5 cents per pound; that of 1914, 7.3 cents, a decline of over 40 per cent. The total value of the former to producers was \$846,000,000; of the latter, \$563,000,000; that is, \$283,000,000 (or one-third) less, although the production was 14 per cent larger. The meaning of this shrinkage to cotton-growing sections may be realized when it is noted that cotton (and cotton seed) represents nearly two-thirds of the value of all crop production in Georgia and Mississippi, 63 per cent in Texas, 60 per cent in Alabama, and 53 per cent in Arkansas. Interference with the exportation of cotton did not prove to be as great as in the early part of the season it was apprehended it would be; for by June 30, 1915, the total year's shipments were within 8 per cent of those of the preceding year; but the value had shrunk 38 per cent, or from \$610,000,000 to \$376,000,000.

#### YIELDS FOR 1915.

The higher prices for grain and the lower prices for cotton stimulated the planting of grain crops in 1915, but caused a considerable reduction in cotton acreage. Coincident with the increased grain acreage and the diminished cotton acreage there was a large yield per acre of grain and only a moderate yield per acre of cotton. The preliminary (not final) estimates of crop production for 1915 indicate that the aggregate will be about 7 per cent greater than that for 1914 and about 17 per cent larger than the average of the preceding five years. If the estimates are approximately correct, there will be record crops of wheat, oats, barley, and hay, the second largest crop of corn, and the third largest of tobacco. The production of potatoes is expected to be about average, at least 10 per cent less than the large crop of 1914.

The cotton crop will be a short one, estimated at less than 11,000,000 bales, compared with a production of 16,135,000 bales last year and with an average yearly production in the preceding five years of 13,033,000 bales. This decrease will result from the reduction of about 15 per cent in the cotton acreage and a 20 per cent poorer yield. The quantity of cotton carried over from the 1914 crop will be considerably larger than usual, but, with the smaller production for the year and the larger domestic demand for cotton for manufacture, the amount exported will decrease unless a decided change in foreign prices occurs.

### PRODUCTION.

#### IMPORTANCE OF RESEARCH.

The obvious need of adequate and effective machinery to make available to the farmer the large body of useful information accumulated through the research work of the department, the State experiment stations, and other agencies sharply engaged the attention of the Congress and the country for several years. The result was the passage of the cooperative agricultural extension law in May, 1914. The plans in operation under this act undoubtedly will go far toward accomplishing the desired end.

Farm marketing and finance have demanded and still require the attention of those interested in the welfare of all classes of the American people. A beginning in this field has been made by the establishment of the Office of Markets and Rural Organization, which is at work upon many important problems.

The fact that special emphasis has been placed upon the improvement of methods of disseminating agricultural information and of marketing farm products does not indicate that all the important problems of production have been solved or that the need for agricultural research is being adequately met. This is indeed far from the case. It is increasingly apparent that as the development of our agriculture brings into use other regions, includes new crops, and makes readjustments necessary to meet changing economic conditions, new and vital problems in research continually are coming to light.

Many investigations, while more or less successful from the standpoint of the scientist, have not progressed far enough to yield results which can be applied safely to improve agricultural practice.

In agriculture, as in medicine, oftentimes knowledge of the causes of trouble is attained long before a remedy is discovered. In other cases results which have been reduced to practice locally require to be tested more widely or to be modified to suit regional conditions. In some very important lines the researches thus far made or now in progress have been on too small a scale to yield satisfactory results.

The limitations of our agricultural knowledge doubtless will be felt more keenly as the rapidly growing system of extension work develops. Rural people thus will be stimulated to study their conditions more carefully and will discover new problems. The record of the past half century indicates that the country relies very largely upon the Department of Agriculture and the State experiment stations for the solution of such problems. It is clearly evident that when normal conditions are restored it will be desirable for the Congress to consider a well-balanced enlarged program for agricultural research.

It is not proposed at this time to suggest the special problems most urgent and of largest practical importance to agriculture for the investigation of which adequate means have not been provided. Undoubtedly active research should be continued on those which arise in connection with the regulatory activities of the department. Beyond this, provision should be made as soon as practicable for the further development of numerous lines of research related directly to production and distribution. While, as in the past, special attention should be paid to investigations having direct and obvious bearing upon practical agriculture, earnest efforts should be put forth to discover underlying principles.

With the funds at its disposal, the department, through its various agencies, has continued to study problems of production. It has assisted in combating plant and animal diseases, in encouraging plant and animal breeding, in promoting better farm methods, in improving farm business, and in encouraging a better balanced agriculture in the various sections of the Union.

#### THE MEAT SUPPLY.

In the last annual report particular attention was called to the desirability of increasing the number of meat animals. The department has given added attention to this problem and has extended its activities as far as available funds permitted. The farmer who



keeps only enough animals to supply meat to his family, as well as the large ranch owner, has received assistance. The attention of the single-crop farmer has been directed to the need of diversification and the introduction of live stock as essential to a sound agricultural economy. That more beef animals should be produced in the settled areas of the country, particularly in the South, is beyond question. In many sections the feeding of beef cattle is one of the best means of utilizing rough feed and of supplying stable manure for crops.

Considerable work has been done in the South by the Bureau of Animal Industry to develop the practice of feeding cotton-seed cake to cattle pastured in summer; and recent experiments have demonstrated the feasibility of feeding calves to produce baby beef. The success of these experiments, it is expected, will lead gradually to a change throughout the entire South. Furthermore, in cooperation with the State agricultural colleges, the production of pure-bred cattle and hogs in the South is being made possible through the organization of live-stock associations and the introduction of registered beef cattle and hogs for breeding purposes.

In the Great Plains region the problem is to utilize roughage and dry-land grains. Remoteness from market or the necessity for raising crops which must be consumed on the farm makes cattle raising imperative. In the Panhandle of Texas demonstrations conducted by the department indicate that beef production may become a feature of farming in that section. Every year a greater number of cattle is fed there and marketed direct. This practice makes it possible to maintain on a smaller acreage more cattle than the old range conditions permitted and greatly enhances the possibilities of beef production.

*Pig and poultry clubs.*—Among the most promising agencies for increasing the meat supply of the country, and particularly that of the individual farm, are the pig clubs. These organizations have been developed as rapidly as funds permitted. Originally started in the South, the clubs have extended into many Northern and Western States, and during the year they had a membership of about 9,000 boys and girls. In 11 counties in Georgia where pig-club work is conducted, 11,000,000 pounds of cured pork were produced during 1914. A large percentage of the farmers in these counties also are producing pork; and the hogs in pig-club communities are increasing

rapidly in quality, size, and value. Over 2,000 registered hogs, of which 75 per cent are sows, are owned by pig-club members.

Poultry clubs likewise have received much attention. These have been organized in 98 counties in 6 Southern States, with a total membership of 4,000. The members are raising poultry for the family table, and the clubs are becoming centers for the development of the community breeding of poultry.

*Elimination of disease.*—Last year the ease with which the meat supply can be increased materially by controlling or eliminating the common live-stock diseases was pointed out. The direct losses from them are enormous. It is impossible to give any accurate statement even of direct losses. The indirect losses, which also are great, can not be estimated at all. It has been conservatively estimated on the basis of data for 30 years that the annual direct losses from animal diseases are approximately \$212,000,000. The loss ascribed to each disease is as follows:

Hog cholera .....	\$75, 000, 000
Texas fever and cattle ticks.....	40, 000, 000
Tuberculosis .....	25, 000, 000
Contagious abortion.....	20, 000, 000
Blackleg.....	6, 000, 000
Anthrax.....	1, 500, 000
Scabies of sheep and cattle.....	4, 600, 000
Glanders .....	5, 000, 000
Other live-stock diseases.....	22, 000, 000
Parasites.....	5, 000, 000
Poultry diseases .....	8, 750, 000

The necessity for vigorous prosecution of work to prevent these losses is obvious. It has been emphatically impressed upon the country since the last outbreak of foot-and-mouth disease, the appearance, spread, and control of which are discussed more fully in another part of this report.

*The cattle tick.*—The work of eradicating the cattle tick in the South has been prosecuted with energy and its progress is making possible a fuller development of the cattle industry in that section. To June 30, 1915, 253,163 square miles had been freed of this pest, 37,255 square miles being opened up during the year. Wherever areas are released from quarantine the cattle industry receives a marked impetus. The northern markets for beef cattle and feeders are open to southern farmers and the southern market to northern

breeders. The elimination of the tick is of great importance to all sections of the country and consequently is a matter of national concern.

*Hog cholera.*—While the eradication of hog cholera must be the work of many years and the department is not ready to suggest any one plan which gives reasonable promise of ultimate success, there is no question that the use of properly prepared serum already has had a pronounced effect. Great numbers of hogs have been saved. The systematic eradication work conducted in certain counties in 16 States shows that 178 hogs in a thousand died from cholera in 1912, 168 in 1913, and only 49 in 1914. Only 62,690 died in these counties in 1914, as compared with approximately 200,000 in each of the two years preceding.

*Public grazing lands.*—An important factor in connection with the country's meat supply is the public grazing domain. The lands outside of the National Forests, of which there are about 280,000,000 acres, are not supporting the number of meat-producing animals they should. In the absence of any control by the Government these lands have been overgrazed. That they can be restored to their former usefulness is proved by what has been accomplished on the National Forests and in Texas. On the Forests under regulated grazing the number of stock has been increased 50 per cent. Practically the same increase has been secured in Texas under its leasing system. There should be a classification of the remaining lands at the earliest possible date to determine their character and to secure information upon which to base plans for their future improvement and use and for the distribution among settlers of those portions upon which it is possible to establish homes.

#### FOOT-AND-MOUTH DISEASE.

An outbreak of foot-and-mouth disease in the fall of 1914 presented a serious menace to the live-stock industry of the United States. First appearing in the vicinity of Niles, Mich., the malady spread to 22 States and the District of Columbia. Work of eradication was undertaken by the department in cooperation with the authorities of these States.

Foot-and-mouth disease, or apthous fever, is highly infectious. It is confined chiefly to cloven-footed animals and is characterized by an eruption on the mucous membrane of the mouth and on the



skin between the toes and above the hoofs. So rapid and sweeping is its spread that when the infection once gains access to a herd or a farm practically every susceptible animal is soon attacked. Although the mortality usually is low, heavy economic losses result from the interruption and derangement of business.

*Previous outbreaks.*—This disease has prevailed in Europe for a great many years and has caused enormous financial losses. It also is common in portions of South America and in the Orient. Only occasionally has it reached the United States. The present is the sixth known visitation. The first three outbreaks, in 1870, 1880, and 1884, were comparatively trifling; those of 1902 and 1908 were more grave; while the latest is the most serious and extensive of all.

In 1870 the infection was brought into Canada with cattle from Scotland. It spread into the New England States and New York but disappeared after a few months. About 1880 two or three lots of animals affected with the disease were brought to the United States; but no trouble followed. In 1884 there was a small outbreak at Portland, Me. The disease spread to a few herds outside the quarantine station, but, owing to the small number of animals and the limited area affected, it was easily controlled.

In November, 1902, the malady was discovered in Massachusetts and Rhode Island and later involved New Hampshire and Vermont. The source of the infection probably was imported cowpox vaccine virus contaminated with the virus of foot-and-mouth disease. This outbreak was eradicated in about six months. The methods consisted of inspection to trace and detect the disease, quarantine of infected premises and territory, slaughter of diseased and exposed animals, and disinfection of premises. Two hundred and five herds, comprising 3,872 cattle, as well as 360 hogs and 320 sheep and goats, were slaughtered. The animals were appraised before slaughter and the Federal Government reimbursed the owners to the extent of 70 per cent, the States paying the remainder. The total cost to the Department of Agriculture of controlling the outbreak was about \$300,000.

The disease next appeared early in November, 1908, in cattle near Danville, Pa. It was traced to the stockyards in East Buffalo, N. Y., and to Detroit, Mich., and extended to other points in Michigan, New York, and Pennsylvania, and to Maryland. Investigation demonstrated that the outbreak started in calves used to propa-

gate vaccine virus at an establishment near Detroit and that the source of the infection was contaminated Japanese vaccine virus. Vigorous measures similar to those employed in 1902-1903 at once were put into effect, and the disease was stamped out in about five months, at an expense to the Department of Agriculture of approximately \$300,000, and to the States of \$113,000. The Federal Government paid two-thirds and the States one-third of the appraised value of the animals slaughtered. One hundred and fifty-seven premises were infected and 3,636 animals were destroyed.

In all the early outbreaks the contagion was introduced with imported animals. Since the establishment by the Department of Agriculture of a stringent system of inspection and quarantine of imported live stock no infection from that source has occurred. On subsequent occasions the disease evidently has been brought in with contaminated products or materials, and not by means of live animals. Early conditions were unfavorable to its extension and made its control possible without rigorous measures. The limited movement of live stock, the comparatively small extent of commerce and transportation, and the relative infrequency of travel at that period all tended to restrict the spread of the infection.

*The 1914 outbreak and difficulties of diagnosis.*—The latest invasion, discovered near Niles, Mich., proved to be the most serious and extensive ever known in this country. Toward the end of August, 1914, the attention of the State veterinarian of Michigan was called by local veterinary practitioners to a disease resembling foot-and-mouth disease in two or three herds of cattle in Berrien County. It was not until October 15 that it was recognized positively in the department as the foot-and-mouth malady. This delay in diagnosis was due to a combination of circumstances, especially to the fact that the infection at first was unusually mild and the lesions were obscured or obliterated by lesions of necrosis, or decayed tissue.

After visiting the locality the State veterinarian consulted an assistant veterinary inspector on the meat-inspection force of the Bureau of Animal Industry at Detroit (in the absence of the inspector in charge), and together, on September 3, they made an examination of the cattle. They failed, however, to recognize the affection as foot-and-mouth disease on account of its mild type, the absence of characteristic lesions, and the presence of lesions hav-

ing the appearance of necrotic stomatitis, or sore mouth. In other words, instead of the typical vesicles or watery blisters, there were present scabs and pus from necrotic ulcers and the odor of necrotic stomatitis. The findings reported by the assistant inspector to the department by telegraph, and also by letter, were that the lesions were characteristic of necrotic stomatitis and that the affection was not foot-and-mouth disease.

A few scrapings forwarded to the pathological laboratory of the Bureau of Animal Industry at Washington apparently indicated a form of stomatitis. They arrived, however, in such a condition as to render it impossible to make a positive diagnosis. In view of the diagnosis of necrotic stomatitis already made, the prevalence of that trouble as reported continuously by different branches of the bureau's service, and the absence of any hint of the presence of foot-and-mouth disease in the United States since 1909, the conclusion of the State veterinarian and the assistant inspector, both of whom had had experience during the outbreak of 1908-9, was not questioned.

It is very difficult and often impossible to make a diagnosis from a bit of tissue. Mixed infection, such as was presented in the case in question, frequently leads to erroneous conclusions. As the virus of foot-and-mouth disease can not be seen with the microscope and will pass through the finest filter, ordinary laboratory procedure will not determine its presence. Inoculation of the usual laboratory animals likewise is insufficient. In the circumstances it is not surprising that a laboratory examination of the pus and scabs failed to disclose the true character of the malady.

On September 24 the pathologist of the State Live Stock Sanitary Commission visited an infected farm near Niles, made an examination of the cattle, and collected specimens, without arriving at a diagnosis of foot-and-mouth disease. Two days later the State veterinarian and the pathologist visited this same farm and several others. The pathologist expressed the belief that the malady was foot-and-mouth disease and suggested to the State veterinarian that he telegraph this opinion to Washington and request that, while awaiting the results of a laboratory examination, an investigation by an expert be made. The State veterinarian agreed with him as to the fact, but thought that the matter should be taken up with the local office of the Bureau of Animal Industry in Detroit instead of directly with the Bureau at Washington. The pathologist took the specimens to Lansing, and on September 28 inoculated a calf. By October 1 the



calf showed fever, drooling, and mouth erosions; but the case was not diagnosed as foot-and-mouth disease because of the absence of foot lesions. Neither these visits, these opinions, nor the results of the inoculation were made known to the department in Washington until October 10.

The pathologist connected with the office of the State veterinarian of Indiana, on October 12, received specimens from infected animals and made cultures which upon microscopic examination disclosed the necrosis bacillus. The presence of this organism was considered sufficient to indicate that the lesions were those of necrotic stomatitis.

On October 5 the State veterinarian of Michigan, the president of the Live Stock Sanitary Commission, and the inspector in charge of the office of the Bureau of Animal Industry at Detroit went to Berrien County to make another examination. A letter from the inspector, in which he included no diagnosis but described in detail certain symptoms pointing to the possibility of foot-and-mouth disease, was received by the chief of the bureau in Washington Saturday afternoon, October 10. This was the first information to reach him giving ground for suspicion that foot-and-mouth disease might be present. The inspector at Detroit had not had any experience with this malady and for that reason did not attempt a diagnosis. An expert was sent from Washington to Michigan on the first train after the letter was received, while calves were inoculated at the bureau's experiment station near Washington. In addition to physical examination, calves also were inoculated by the expert on the ground.

*Spread of infection and steps for eradication.*—Immediately after the discovery of the true nature of the disease a force of inspectors was dispatched to the infected locality. A thorough canvass disclosed, up to October 17, 39 infected herds in southern Michigan and 7 in northern Indiana. An order, effective October 19, was issued, placing under quarantine the counties of Berrien and Cass, in Michigan, and St. Joseph and Laporte, in Indiana.

The infection seems to have been carried in milk to the creameries at Buchanan, Mich. The skimmed milk was fed to hogs and the disease was communicated to them. A carload of the hogs, before these facts were known, was shipped to Chicago and doubtless carried the infection to the Union Stock Yards there. From that point it was spread by shipments of live stock to various parts of the

country. Some of the large eastern stockyards became involved, and the disease was disseminated from them. It extended to the following States, besides the District of Columbia: Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, Washington, West Virginia, and Wisconsin.

On October 28, when the movement of stock from the originally infected center in Michigan had been traced to the Union Stock Yards, an order was prepared, effective October 31, quarantining those yards and permitting animals to be shipped from them only for immediate slaughter. Numerous other quarantine orders were issued from time to time, as infection was discovered or as other conditions warranted. They not only prohibited or restricted the movement of certain farm animals, but regulated the movement of hay, straw, and other possibly dangerous materials.

Steps were taken to enlist in the work of eradication the aid of the authorities of the States affected. Satisfactory arrangements rapidly were made, and the work has been prosecuted jointly by the department and the States. The costs incurred have been divided about equally between the Federal and State Governments.

*Methods and progress of eradication.*—The methods of eradication were similar to those used in the outbreaks of 1902 and 1908, with such improvements in detail as experience suggested. The veterinary and other forces of the Bureau of Animal Industry in various parts of the country were drawn upon in order, with the least possible delay, to place inspectors where they were needed. It was necessary to trace the movement of live stock from infected premises and regions, to examine railway and stockyard records, to trace and locate cars that had carried infected stock, to clean and disinfect them, to go from farm to farm and examine all susceptible animals, to enforce local and general quarantines of the Federal and State Governments, to slaughter and bury as quickly as possible all diseased and exposed animals, and to disinfect the premises that had been occupied by them. To avoid the spread of infection by inspectors and other employees these men were required to wear rubber outer clothing, which could be washed easily with disinfectants, and to fumigate and disinfect themselves before leaving premises visited by them. Before slaughter the animals were appraised by an official

agreed upon by the State authorities and the department, and the owners later were paid the stipulated amount. The appraisal was based upon the meat or dairy value of the animals.

For a time the disease continued to appear in new territory and new cases were found more rapidly than it was possible to dispose of old ones. After months of vigorous work, however, the outbreak was brought under control, the spread of the disease was checked, and there was a steady diminution in the number of cases. On June 18, 1915, the last herd known to be infected at that time had been slaughtered and buried and the premises disinfected.

*Sources of infection.*—The exact origin of this outbreak has not been discovered, although there seems to be no doubt that the infection was introduced from a foreign country. An effort was made to trace the source of infection of each diseased herd and the information obtained has been classified. The principal means of transmission was the shipment of animals directly from public stockyards (707 out of a total of 3,021 herds investigated). Neighborhood visiting caused infection of the next largest number (509); direct contact with neighboring animals, of 346; animals brought from infected stables or lots, of 285; creameries, of 269; and dogs, poultry, and birds, of 146.

*The National Dairy Show herd.*—The cattle exhibited at the National Dairy Show in Chicago, October 22–31, 1914, constituted a special problem. Before its opening the local inspector of the Bureau of Animal Industry warned the manager of the danger of holding it because of the recent discovery of foot-and-mouth disease. At the close of the show the department, as a precautionary measure, requested the State veterinarian to detain the cattle for a few days to determine whether they had become infected. On November 1 one of the cows developed the disease, and the herd immediately was placed under close quarantine by the State.

This herd consisted of over 700 head of very valuable pure-bred cattle. Their slaughter would have been a misfortune. The conditions under which the animals were held made it possible to maintain a quarantine, and it was decided to try to save them. They were confined in a brick building, where it was practicable to establish hospital conditions and to prevent ingress and egress of persons and animals except under absolute control. All persons were pro-



hibited from leaving the building until they had been thoroughly disinfected. No dogs, cats, poultry, or birds could gain access to the building. Apparently the animals made a complete recovery and were released from quarantine May 31, 1915, after very thorough tests had demonstrated that the herd did not harbor infection.

*Recurrence of the disease.*—On August 8, 1915, the local inspector in charge of field work at Chicago telephoned to Washington that a case of foot-and-mouth disease had been discovered among 119 hogs and 4 cattle at Wheeling, Cook County, Ill., 22 miles north of Chicago. It seems certain that this infection was produced by contaminated hog-cholera serum prepared in Chicago in October, 1914, at an establishment where the disease had not been known to exist at any time. This material had been kept in cold storage and was not used until the quarantine restrictions had been removed in July, 1915, and after negative tests on hogs had been made. Pending investigation, all shipments of serum from Chicago were prohibited. It was found that some of the product of the establishment had been used on 11 herds of hogs, 8 of which were in Illinois and 1 each in Minnesota, Michigan, and Indiana. A few infected hogs were found in 8 of the herds, and all these herds, as well as the three in which no disease was found, were slaughtered at once.

A portion of the serum actually used was procured from the owners of the hogs, together with samples of the remaining stock of the company. Pigs and calves, the animals most susceptible to the disease, were inoculated with these. The results again were negative, and after two series of tests had been made the Federal Public Health Service was asked to conduct a third series. This also was negative.

Up to this time, therefore, four series of tests had been made, in which a total of 52 animals had been used, none of which developed foot-and-mouth disease. The inoculations afforded no evidence that the serum in any way was contaminated. Each series apparently only confirmed the test made before the material was permitted to be placed upon the market. The fact remained, however, that the hogs treated by the owners had developed the disease. A fifth test therefore was made, and 10 days after inoculation a calf, which was the sixty-second animal used in the tests, developed characteristic lesions. The diagnosis of foot-and-mouth disease subsequently was confirmed by the inoculation of other animals with material from the infected calf.

This is regarded as proof that the suspected serum actually was infected. Why the standard tests used on 61 animals failed to reveal this fact is a matter for scientific investigation, and the bacteriologists of the department are at work upon the problem. At the time of manufacture one-half of 1 per cent of carbolic acid was mixed with the serum as a preservative. It is now believed that the acid, acting as a germicide, may have attenuated or partially destroyed the virus so that tests previously considered safe failed to establish the presence of the infection. It also is possible that the virus, instead of being disseminated throughout the entire mass of serum, may have become agglutinated. This has been known to occur with germs of other diseases. The result would be the formation in the fluid of isolated clumps of foot-and-mouth disease virus, while the bulk of it remained free from these tiny masses. If this occurred it is obvious that certain animals inoculated with the serum would develop the malady and others would escape. Up to the present time the germ has not been identified, although the scientists of Europe have studied the disease exhaustively for many years.

Experiments are being prosecuted vigorously in the department with a view to discover a means of treating serum at the time of its manufacture which will kill the virus of foot-and-mouth disease. The results so far attained are promising, and the department hopes that a successful method soon will be evolved. In the meantime all infected serum in the hands of the manufacturer, as well as all other suspected serum manufactured in Chicago, has been destroyed. Furthermore, the department is prohibiting the shipment of serum from licensed establishments in the districts under quarantine for foot-and-mouth disease.

*Appraisements of diseased animals.*—In the handling of the problem difficulties arose because of the fact that the department in making appraisements of diseased animals did not feel authorized to take into consideration their breeding value. In some cases fine herds were involved. In all the discussions of the matter before the Agricultural Committees of the Congress the beef or dairy value was indicated as the basis for appraisal, and in former outbreaks this basis was used. The suggestion was made that the department be authorized to take breeding value into consideration; but the Congress, in making an appropriation to reimburse the

owners of the National Dairy Show herd for expenses incurred by them incident to the quarantine, specifically provided that the beef or dairy value only should be the basis of the appraisement. As the disease still prevails in certain parts of Illinois and there is no guaranty that it may not spread, it would seem that for the ensuing year an appropriation equal to the current one should be made. It may not be necessary to expend the appropriation; but it would be exceedingly unfortunate if the disease were to spread or reappear and the department had no adequate funds or authority. The estimates contain an item covering this matter. In connection with it the suggestion is made that in payment for animals hereafter purchased for slaughter the appraisement may be based on the beef, dairy, or breeding value, provided that in case of appraisement based on breeding value no payment for any animal shall exceed three times the beef or dairy value. Both equity and practical expediency justify taking breeding value into account. The practical consideration is this: Prompt action is of the highest importance, and if owners feel that they will not receive a fair return they may resist the Federal and State authorities. A maximum limit also seems essential to speedy settlement. The department would exercise the requisite care and is not apprehensive that extravagant appraisements would be permitted.

#### HOG CHOLERA AND SERUM.

Experiments for the purpose of determining the best method to control or eradicate hog cholera demonstrate that, by employing certain systems involving the use of hog-cholera serum, losses can be reduced to a minimum and the swine industry greatly benefited. The work also shows, however, that success over a large territory would require the employment of an immense force of men and the expenditure of enormous sums. It seems that, at the present time, a country-wide campaign for the eradication of the disease would be ill advised. The problem is not one for the Federal Government alone. Before an active campaign is begun the various States should have more effective laws relating to diseases of live stock and more extensive organizations for enforcing such laws.

In round numbers, there are produced annually in the United States 200,000,000 cubic centimeters of serum. Of this amount, approximately 50,000,000 cubic centimeters, or about 25 per cent, are prepared by State governments. Serum is produced by the Federal



Government for experimental purposes only. The remaining 150,000,000 cubic centimeters are manufactured by private establishments. It is probable that there are in operation in the United States between 90 and 100 such establishments. Of these, 81 have secured licenses from the Department of Agriculture under the virus-serum-toxin act of 1913, and thereby are enabled to carry on interstate business. Of the total quantity of serum privately prepared, it is estimated that more than 90 per cent comes from plants holding licenses from the department.

*The Virus-Serum-Toxin Act.*—The statute prohibits the shipment from one State or Territory to another State or Territory of any virus, serum, toxin, or analogous product which has not been prepared at a plant holding an unsuspended and unrevoked license from the Department of Agriculture. It also is made unlawful to ship interstate any virus, serum, toxin, or analogous product which is worthless, contaminated, dangerous, or harmful.

The department is authorized to make and promulgate such rules and regulations as may be necessary to prevent the preparation, sale, barter, exchange, or shipment in interstate commerce of worthless or contaminated viruses, serums, etc. It is provided that a license shall be issued on condition that the licensee shall permit the inspection of his establishment and of the products and their preparation. The department may suspend or revoke licenses after opportunity for hearing has been granted. The law gives authority for Federal agents or employees to enter and inspect any licensed plant at any hour. Penalties of fine or imprisonment, or both, are provided for violations.

In carrying out the virus-serum-toxin act the department has issued regulations designed to prevent the interstate shipment of worthless, contaminated, dangerous, or harmful hog-cholera serum, hog-cholera virus, and other products. Fifty-six trained inspectors are assigned to the work of inspecting the licensed plants and detecting violations of the law. A number of violations, particularly shipments of serum not prepared at establishments holding licenses, have been discovered and successfully prosecuted. Notwithstanding the efforts of the department, apparently there have been shipments of contaminated or worthless serum by licensed companies. These occurrences have resulted in part from the ignorance or carelessness of the owners. In some cases they have been due, perhaps, to

cupidity; in others, to novel situations presented by the unexpected outbreak of foot-and-mouth disease.

There seems to be a widespread belief that the products of a licensed establishment in some way are certified or guaranteed by the Federal Government. Under the existing system it has not been possible for the department to assure users of the quality of such articles. The business of serum production is such that supervisory inspection alone, without complete control, and with power to penalize violations of the law only by revocation of licenses or by prosecution, is not sufficient to warrant the assumption by the Government of responsibility for the products.

*Control of serum production.*—The recent cases of infection of serum and virus with foot-and-mouth disease indicate that some more effective form of control over serum production is most desirable. It has been suggested that the object could be accomplished by Government ownership. While there is much to be said in favor of such a plan, it seems doubtful whether it would be practicable. Certainly it would seem unwise for the Government to produce the material unless it could control the entire output. Recent information shows that 21 States have established plants and now are engaged in the production of serum on a comparatively large scale. It is a question whether these States, with their active organizations, would wish or consent to discontinue the work. Aside from this, the purchase of the establishments now in existence and the erection of others by the Federal Government would necessitate a large outlay. Even though this expenditure were made, it must be remembered that Government officials are liable to error, and that Federal manufacture, though it secured honesty of methods, would not serve as a guaranty that no contaminated or worthless serum would be sold.

*Government test station.*—As a substitute for Government ownership, the following plan merits careful consideration:

- (1) Continue the inspection service as at present constituted under the act of 1913, maintaining a sufficient force of inspectors so that all important processes of licensed establishments may be carried out under the constant supervision of department employees; and require that all products after preparation be securely locked up by employees of the department, whose duty it shall be to withdraw representative samples.

(2) Provide by law for—

(a) The establishment and maintenance of a "Government test station" for serum. The purpose of this station would be to receive official samples of all serum produced by licensed plants and to test them for purity and potency. Upon completion of the test the official in charge immediately would make known the results to the inspector at the plant from which the sample was derived, and the material, if found potent and pure, then would be released with proper markings or seals to show that it had been tested.

(b) The prohibition of the interstate shipment of any product a sample of which had not been tested and found pure and potent.

(c) The imposition of a tax upon all serum, samples of which have been tested, with adequate provision for the affixing of tax stamps and marks prior to sale or shipment.

The available methods for determining purity and potency are not scientifically exact. Tests, however, are a necessary and most important part of any system of control. They are now made by the commercial establishments themselves on animals procured by them and at all times under their care. It is impracticable for the Government to make them within privately owned and operated plants. Furthermore, so long as the plants conduct the tests, it is manifest that the Government can not select and know the complete history of the animals. In the preparation of the serum, the inspectors can see that the steps necessary to produce a good article are carried out. In this particular the inspection is adequate and effective. It appears, therefore, that the weak point at present is the inspection of the tests, and the department believes that these should be under Government control. At the same time, not being absolute, they should be supplemented. Supervision at the producing plants of the methods of preparation and handling should be continued.

It is probable that an adequate test station could be provided for about \$50,000. If several were found to be desirable, a suitable appropriation for each would have to be made. The cost of maintaining a station capable of testing the entire output of commercial serum in the United States probably would not exceed \$150,000 annually.

The suggestion is made that a tax sufficient to cover the cost of maintaining the station should be imposed. This tax should not operate to increase the cost of serum to the farmer, because manufac-



turers would be relieved of the expense of conducting their own tests. While the plan indicated contemplates control only of serum intended for shipment in interstate commerce, it is likely that the States would take similar action and apply similar rules to their own plants as well as to private establishments doing business wholly within the State. The plan probably would be effective and would require little additional expenditure of public funds.

#### CITRUS CANCKER.

The citrus industry of the Gulf States is seriously threatened by citrus canker. This has been found to be a highly infectious bacterial disease. An emergency appropriation of \$35,000, which became available January 28, 1915, enabled the department to cooperate with the States of Florida, Alabama, Mississippi, Louisiana, and Texas in an effort to eradicate the trouble, the department bearing the cost of the inspection work, while the expense incident to the actual destruction of trees was borne by the respective States. The work of inspection and eradication has progressed very satisfactorily, although the disease is more widely scattered and is more serious than at first was supposed. In Texas, Mississippi, and Alabama the greater number of the infected centers have been eliminated, and, if it is possible for these States to maintain a thorough inspection during the coming year, there appears to be no reason why the disease should not be completely eradicated from these regions. In Louisiana and Florida the greater portion of the infected areas seems to be under control, but the complete elimination of the disease, especially from the latter State, probably will require large expenditures for at least two years.

#### POTASH SUPPLY.

The potash situation continues very serious and a grave condition confronts the American farmer. There is practically no potash in this country for fertilizer use, and present indications are that the supply for this purpose will not be increased materially during the coming year. The investigations of the department and of the Geological Survey have shown the possibility of producing from American sources an ample quantity of potassium salts for domestic consumption. During the year no new sources have been discovered, but the conditions surrounding the development of known sources have been clarified considerably. There are four possible

domestic sources of potash: The giant kelp of the Pacific coast from Lower California to Alaska; the alunite deposits, mainly in the mountains of Utah; the feldspathic rocks of the eastern part of the United States; and the mud of Searles Lake, in California.

Undoubtedly a large supply of potash salts could be obtained from the giant kelp. The kelp beds have been surveyed and a report, accompanied by maps showing in detail their extent and location, has been issued. Harvesting is accomplished easily, as the kelp grows in open water and barges fitted with mowing attachments can be used.

For utilizing the kelp several methods are feasible. It may be dried and ground. In this condition it contains all the salts originally present, which are mainly potassium chlorid and sodium chlorid. This material has ideal mechanical properties for use in mixed fertilizers. When the pure potassium chlorid is desired it is necessary to separate the juice from the organic material and then to remove the sodium chlorid. The latter can be done readily by recrystallization; but the separation of the juice from the organic material is more difficult, for the reason that the kelp is nonfibrous and in attempts to effect separation by filtration the filters become clogged and unworkable. The problems yet to be worked out commercially are the best methods of drying the wet kelp and of effecting the ready and efficient separation of the plant juices from the organic material. Investigation of these questions has proceeded far enough to indicate that their solution should not be very difficult.

But the development of a supply of potash from the kelp beds is still remote. There are several reasons for this. No one knows how long the European war may last or how soon potash from the former usual sources may be available. The American fertilizer companies heretofore have depended largely on the mining of phosphate rock and the manufacture of sulphuric acid for superphosphates. In these lines they are deeply interested financially. There is, furthermore, an element of doubt as to the control of the kelp beds. Just what jurisdiction the Federal Government has over them does not appear, and the Pacific Coast States have not legislated concerning those lying opposite their shores. It is unlikely, even in the event of an early peace, that there immediately will be a great supply of potash salts. It is a question how long it would take the former agencies to resume their usual operations. The experts of the department are of the opinion that under normal conditions, if the Panama



Canal is utilized, potash from the kelp beds of the Pacific coast can be sold in the East under free competition.

Next to the kelp the massive alunites present the best possibilities as a source of potash. This material is decomposed by roasting, with the evolution of oxids of sulphur, and a residue consisting of alumina and potassium sulphate remains. From this residue the potassium salt can be obtained readily by leaching and evaporation. The process is simple. The fumes liberated could be used to manufacture sulphuric acid; but this commodity would be in little demand in the locality and some method of disposal or utilization would have to be devised. Alumina resulting as a by-product would be suitable for the manufacture of metallic aluminum; but this metal is produced by one concern which controls sufficient bauxite deposits for its purposes and is not interested in other sources of alumina.

Work has been done along the line of producing potash from feldspar. This is commercially feasible if a salable by-product can be secured at the same time. The suggestion has been made by the Bureau of Soils that cement is a possible product from the feldspar treated to render the potash soluble. But the difficulty of marketing this cement in competition with thoroughly standardized products would be a great deterring factor.

The development of Searles Lake as a source of potash presents a number of unsolved technical problems. In addition, the question of title to the property is so involved that considerable time will elapse before it can be settled. In the meantime nothing can be done.

It is a matter of distinct regret that responsible business concerns have not made more earnest efforts to provide potash for agricultural purposes. Only recently, although the need of potash has been felt for a year, two companies have begun to develop a supply from alunite, but undoubtedly it will be some months before any considerable quantity from this source can be placed upon the market.

#### MARKETING AND DISTRIBUTION.

Public interest in the problems of marketing and distribution still is keen. This is reflected in requests for information and assistance so numerous as heavily to tax the Office of Markets and Rural Organization. The department has continued with the increased funds at its disposal to develop its organization for studying these problems by adding to its staff the best trained men available.

Very satisfactory headway has been made and results of much value have been secured.

It perhaps would conduce to clearness of thinking to realize that neither specific legislation affecting either marketing or rural finance nor direct attack on specific problems of marketing and rural credits by special investigators, even if the results of the studies were sound and convincing and received concrete application, can furnish a full solution of all the difficulties. It is not generally appreciated to what extent marketing troubles have their origin in irregularity of production or in lack of a stable and balanced agriculture; neither is it recognized that the difficulties which some expect to remove by rural credits legislation can be obviated only by improvement in conditions governing the conduct of farm operations, the trading in farm products, and the ownership and exchange of farm lands.

Irregularity in production in some instances arises from conditions over which there is no easy control. In years when a destructive disease prevails the yield from an acreage normally sufficient to supply consuming requirements is insufficient to meet the demand, and high prices follow. High prices also may result from reduced acreage, caused by low prices at planting time. High prices one year stimulate heavy planting the next. A solution for evils of this sort lies in stabilization of production. This can be brought about in part by the acquisition of fuller information as to the relation of acreage to consumption demands and to local marketing possibilities, the regional and local adaptation of crops and crop varieties, including the breeding and introduction of resistant varieties, and the control of crop pests.

In some sections, especially those which are new and developing, the difficulty is enhanced by the activities of real-estate promoters who succeed in directing farmers into localities, frequently remote from markets, where they successfully produce crops to the disposal of which they have given no consideration. In most instances disaster follows. Whether the States or the localities might not develop responsible agencies for the intelligent guidance of farmers in these directions is a matter for serious consideration.

One of the first questions that should be asked by a farmer who is considering a readjustment of his plans or who is undertaking tasks for the first time is whether the scale of his operations is such as to

furnish full and economical employment to the farm family and to the work animals throughout the year. The minimum practical farm unit appears to be a farm of such size as will give adequate continuous occupation to the family. The unit for efficiency is somewhat larger than this. It has been found in one of our leading dairy sections that on farms of less than 100 acres the number of days' work for each individual employed is less than the full working capacity. In that locality a farm of this size gives full employment to two regular men, in addition to the extra help required at harvest time. Not only does the large farm utilize labor to better advantage, but it requires fewer animals to work a given area and is better supplied with labor-saving machinery. Farmers quite generally are beginning to recognize the fact that production is cheaper on large farms than on small ones and that the profits are greater for each unit of labor. There are thus forces at work to increase the magnitude of the farm business and statistics show that the agriculture of the country slowly is responding. Still, in the vicinity of large cities there is a tendency toward intensive farming, and on the Atlantic seaboard the acreage of improved land in the farm decreased from 69 acres in 1850 to 56 acres in 1910. In the cotton belt there has been a decrease since 1860 from 125 to 37 acres. This is due mainly to the breaking up of the large plantations. In the North Central States the proportion of land that can be devoted to intensive farming is relatively small, and in that section there has been an increase in the acreage of improved farms from 61 acres in 1850 to 113 in 1910.

As stated in the last annual report, there is much land in this country to be brought under cultivation; but this land in general is more difficult of access or more difficult to bring into use than that which is now cultivated. Future increase in production must come largely through better management of the land in cultivation. In a number of sections, however, there could be an extension of the land in use without much difficulty. This would result in greater economy and efficiency in the use of the labor of men and work animals. The Office of Farm Management has made a careful survey of a part of the Piedmont section of South Carolina. It finds that the size of the average farm there is 76 acres, while the area of land under cultivation in the farm is only 34 acres. It discovers that there are in this section 215 available work days and that, partly because of the small size of the farm and partly because of the too



exclusive reliance on one or two crops, there is a failure to utilize the available labor by approximately 50 per cent. Obviously, the direction of effort should be in the extension of activity over a larger farm area and of diversification.

Another vital question the farmer should ask himself is what he can do with his product when he secures it. Even if farms everywhere were of the requisite size for efficiency in production and reasonable diversification were practiced, the difficulties would not be solved. The farm unit which may be efficient for production still would have acutely to consider the problem of marketing. The farmer would not, through his own resources, be able to command easily the requisite transportation facilities or the daily information needed as to market conditions and the best near-by market, and in most cases would be at a disadvantage in bargaining with purchasers. The most promising solution seems to lie in the development of community cooperation or team work to determine what to produce, to employ the same methods, and to secure marketing information so as to enable producers to deal with buyers on an equal basis.

There are problems, however, which, under existing conditions, neither efficient individual nor community effort can solve. These can be reached only by legislation. There is much that individuals and groups of individuals may do in every community. In fact, they must always do the larger part. Self-help will be the rule in the future, as it has been in the past. Nevertheless, there are certain undesirable and unjust conditions which no amount of private effort, whether engaged in by farmers singly or jointly, can overcome. These conditions statutory enactments alone can correct. The better handling and storage of farm products, as well as trading on the basis of fixed grades and standards, wait upon proper legislation.

Among the difficulties of American farmers are lack of familiarity with, and remoteness from, the actual machinery of distribution and finance; absence of order or system in the conduct of their own business transactions; inadequacy of storage facilities for their products; and ignorance of what their products really are in the terms of market phraseology, as well as what they are worth. A producer of a manufactured article knows what it is and what it costs. He knows this better than the buyer. The reverse is true in agriculture. The farmer, as a rule, does not know what his product is or what he is selling, while the buyer knows what he is buying.



The solution of these difficulties involves a better system of warehouses, with receipts which will be acceptable as collateral; the establishment of standards and grades of grain and cotton and other staple crops; the trading in the market upon standard types or grades, ascertained and fixed by the Government, with such supervision and control over the operation of exchanges as may be essential to secure justice for the producer, the consumer, and the intermediary.

For the accomplishment of these ends it seems desirable that the cotton-futures act, which has been in operation about a year, should be supplemented by a Federal permissive warehouse act, a cotton-standards act, a grain-grades act, and a land-mortgage banking act which shall inject business methods into the handling of farm finance and place upon the market in a responsible way reliable farm securities.

The Office of Markets and Rural Organization has definitely planned to keep in close touch with individuals and associations dealing with particular marketing problems over specific sections of the Union. Conferences with groups of producers interested in the same problems have been held and others will follow as occasion warrants, and it is believed that the establishment of advisory relations will have important results.

For a detailed account of the investigations and of the results of the activities of the Office of Markets and Rural Organization reference is made to its annual report. I shall touch upon only a few phases of the work.

#### MARKET NEWS SERVICE.

Shippers and distributors of perishable products long have felt the need of accurate information concerning the quantities arriving in the large markets. Reliable records of shipments have been wholly lacking; and it has been practically impossible to obtain accurate and comprehensive reports of current wholesale and jobbing prices.

The feasibility of securing and disseminating information of this character through a public market news service was tested during the year. The results point to the conclusion that a larger and better supported service should be given a trial. Several methods of securing market reports were tried out and their limits of usefulness established. Special telegraphic connections were secured, and representatives of the department in important shipping areas and in the larger markets kept both producers and dealers supplied by

telegraph with the latest news of crop movements and prices. The service was rendered in succession to the growers and shippers of strawberries, tomatoes, cantaloupes, and peaches, and to the shippers of northwestern pears. In several of the more important districts the information has resulted in a wider or more intelligent distribution, the avoidance of gluts in specific markets, fewer diversions of cars in transit, and a consequent shortening of time between the producer and the consumer.

#### THE COTTON-FUTURES ACT.

The United States cotton-futures act is the first general regulative statute passed by the Congress for the improvement of marketing conditions. It was enacted August 18, 1914, and became operative February 18, 1915. Sufficient time has elapsed to enable one to judge, in some measure, whether it is accomplishing the purposes intended.

The quotations of future contracts on cotton exchanges have a commanding influence upon the prices paid for spot cotton. Preceding the adoption of the law it was generally believed that these quotations were not true barometers of spot-cotton values, but usually were unwarrantably low and at times fluctuated unduly in response to manipulative influences. This condition was attributed largely to certain evil features which had crept into the practices on future exchanges as embodied in their contracts.

The act is a taxing statute, applicable to all contracts for the future delivery of cotton entered into on exchanges and like institutions. It aims to bring the future exchanges to a performance of their true economic functions by inducing them to adopt a form of contract free from evil elements. Its motive is to eliminate unfair competition. It is in the interest alike of producers, merchants, spinners, and exchange members.

After the passage of the act, even before it became operative, the cotton-future exchanges in this country adopted the form of contract prescribed in its fifth section, and since, with negligible exceptions, they have traded exclusively under this form. Careful observation since the new form of contract came into use indicates that the statute has accomplished the chief economic objects anticipated by its framers. Future quotations now represent spot values more accurately; sharp and sudden fluctuations, such as commonly occurred

under the old practices, have become much less frequent; and prices have been increasingly stabilized. The conclusion is unavoidable that these results are due mainly to the operation of the act.

Primarily these changes help the producer to secure more equitable prices. They also benefit the cotton manufacturer by giving him a truer index of the advance value of raw material. Likewise, they afford to all concerned in financing the crop and moving it to market a safer and more practicable hedge. In addition, the exchanges themselves have been somewhat relieved from the suspicion, which formerly justly attached in considerable measure, that exchange transactions were not always fairly conducted.

*Cotton standards.*—One of the important sections of the act is that dealing with standards. It authorizes the department to promulgate standards of cotton by which its quality or value may be determined, to be known as the "Official cotton standards of the United States." Acting under this authority, the department prepared a set of standards for white cotton, consisting of nine grades, as follows: Middling Fair, Strict Good Middling, Good Middling, Strict Middling, Middling, Strict Low Middling, Low Middling, Strict Good Ordinary, and Good Ordinary. Pains were taken to make them comprehensive, and they are more truly representative of American cotton than any standards hitherto in use. They were promulgated December 15, 1914, and replaced the permissive standards adopted by the department in 1909.<sup>\*</sup> To the close of November 10, 1915, 529 full and 19 fractional sets had been distributed to exchanges, spot-cotton dealers, merchants, cotton mills, agricultural colleges, and textile schools in the United States; in addition, 16 full sets and 1 fractional set had been shipped to foreign countries.

While the compulsory use of the official standards extends only to contracts made subject to section 5, their acceptance and use have not been limited to the future exchanges. They have been voluntarily accepted in all the more important spot markets and form the basis of their dealings. The standards have given general satisfaction and the tendency toward acceptance of them has not been confined to this country. Committees and the board of managers of the Liverpool Cotton Association have approved them, though they have not been adopted by the association itself. The question of using both the official standards and the form of contract prescribed by the act is under consideration by the exchange at Bremen, and



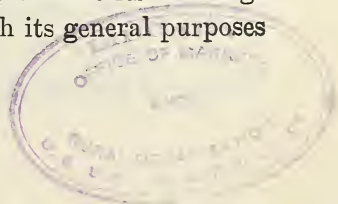
there have been negotiations on the subject with the exchange at Havre and a proposed exchange in Rotterdam.

It has not been possible, largely because of the lack of suitable type material, to establish standards for tinged and stained cotton. However, for convenience in passing on disputes, and in order to facilitate the work of classification of cotton proposed for tender on contract on the exchanges, the department has prepared tentative types for Low Middling yellow tinged, Low Middling blue tinged, and Middling yellow stained cotton. Duplicates of these have been distributed to the various exchanges for use pending the promulgation of the official standards.

*Determination of disputes.*—As an incident to the settlement of contracts made in the form prescribed by section 5 of the act, and as a means of bringing about uniformity in methods of grading and classification, the act imposed upon the department the duty of determining disputes involving grade, length of staple, and quality of cotton offered for delivery referred to it by the parties to such contracts. To the close of November 10, 1915, 1,002 disputes, involving 65,654 bales of cotton, had been submitted for determination. The costs of the 988 disputes decided amounted to \$22,773.75. These were paid by the parties.

*Spot markets.*—The statute requires the department to designate the bona fide spot markets. It prescribes also that the averages of spot values in such of these as may be selected for the purpose shall, in the settlement of contracts made in compliance with the act, be the basis for determining actual commercial differences in the values of grades in future markets which are not themselves spot markets. Of the spot markets accepting the official standards, 13 have been designated as bona fide spot markets. Of these, 11 were selected for use in determining differences in values between grades of cotton delivered on contracts made on the exchanges subject to the act in places which are not spot markets. The latter furnish the department by wire daily quotations based on sales of cotton according to the official standards.

It is gratifying to note that a large majority of the people affected by the act, after having had an opportunity to observe its workings for the past eight months, are in sympathy with its general purposes and indorse what has been accomplished.





## WAREHOUSE LEGISLATION.

Investigations conducted by the Office of Markets and Rural Organization indicate that there is serious need of warehouse legislation. It would seem that the most desirable action on the part of the States would be the passage of laws which would guarantee the integrity of warehouse receipts. These laws should be uniform, so that the conditions governing such receipts may be the same throughout the country, thereby greatly increasing their availability as collateral for loans at distant banking centers. The uniform warehouse receipts act is now in force in 31 States.

In addition to the legislation that has been or may be enacted by the States, it is believed that the enactment of a Federal warehouse law would be of great benefit. The general interest in the subject is well shown by the inquiries the department constantly is receiving. In fact, many warehousemen, under the misapprehension that a bill on the subject considered by the last Congress actually had been passed, have asked the department to give them information as to how to comply with it. The proposed measure, which is permissive in character, would enable the Department of Agriculture to license bonded warehouses in the various States. It would promote the better storing of farm products, increase the desirability of receipts as collateral for loans, and therefore would be of definite assistance in financing crops. A Federal statute on the subject also would promote the standardizing of storages, of warehouse receipts, and of marketing processes. //

## RURAL CREDITS.

The department has continued its studies of rural financial conditions in this country. It has investigated the relations of banks, life insurance, and mortgage companies to farm-mortgage credit and those of banks and merchants to the financing of farm operations. It has examined the recent legislation relating to personal-credit unions, extended its investigations of interest rates and other charges on farm mortgages and personal and collateral loans, and studied the possible forms of organization for personal-credit associations. It has issued bulletins bearing on the subject and has responded to many requests for information and assistance from individuals, groups of individuals, and State authorities.

The duty of preparing and reporting to the Congress on or before January 1, 1916, a bill or bills providing for the establishment of a system of rural credits adapted to American needs and conditions has been imposed upon a joint committee of the House and Senate. It is expected that as a result of the deliberations of this committee legislation will be proposed which will furnish a practical solution of the problem from the financial viewpoint.

It is generally recognized that the rural-credit problem is not a simple one. It is essentially complex. There is no single solution of it. Specific financial legislation on the part of the Federal Government, or of the State, or of both, will not furnish a full solution. It seems clear that there should be a Federal law providing for a land-mortgage banking system. It is a question whether by Federal action existing banking arrangements may not be so modified as to bring them into closer contact with rural communities and with individual farmers, giving farm collateral more readily and fully the advantages of the rediscount feature of the Federal Reserve Act. It also seems clear that legislation on the part of States permitting and encouraging the creation of personal-credit unions and removing any obstacles that may exist to the easier and more orderly handling of farm finance should be enacted. Reenforcing such agencies there would be at work all the great forces of the Department of Agriculture, of the land-grant colleges, and of the State agricultural departments. Their activities all contribute to make agriculture more profitable, to improve distribution, to eliminate waste, and to inject business methods into farming. In proportion as they accomplish these tasks they tend to solve fundamentally the whole problem of rural credits. Further Federal legislation vitally important to a more efficient agriculture, such as a cotton-standards act, a grain-grades bill, a permissive warehouse law, and proposals for the improvement of marketing conditions, also will contribute directly to its solution.

But even if all the desirable legislation were enacted and were put into operation there still would be a vast amount of constructive work to be done by individuals and groups of individuals, including the farmer, the business man, and the banker. If these assume a helpful and constructive attitude, they will furnish indispensable support for practical reforms. All these forces working in combi-

nation can effect marked changes in conditions, especially of the very class of farmers whose state most critically excites interest and concern.

#### FUR-BEARING ANIMALS IN ALASKA.

Under the Alaska game law of May 11, 1908 (35 Stat., 102), regulation of the killing of certain terrestrial animals and of sea lions and walruses is committed to the Department of Agriculture. For several years the Congress has made appropriations to enable the department to make investigations and experiments in connection with rearing fur-bearing animals, including minks and martens. The fisheries of Alaska are under the direction of the Department of Commerce, which also administers the laws relating to fur seals and those governing the killing of minks, martens, sables, and other terrestrial fur-bearing animals in Alaska.

Early in 1915 a joint committee of the Departments of Commerce and Agriculture was appointed to devise a plan to simplify the administration of the Aleutian Islands Reservation in Alaska in respect to the propagation and protection of fur-bearing animals. The committee concluded that the problem was a broader one and reported that the present distribution of authority over fur-bearing animals between the two departments is unwise. It recommended that jurisdiction over land fur-bearing animals be committed to the Department of Agriculture and that over aquatic fur-bearing animals to the Department of Commerce. This action would adjust the powers of each department to its present functions and special equipment. It would place under the Department of Commerce not only fur seals and sea otters, as at present, but also walruses and sea lions which are now under the supervision of the Department of Agriculture; and under the latter department, land fur-bearing animals, including minks, martens, and sables, which are now under the jurisdiction of the Department of Commerce. The committee's report was approved by the Secretary of Commerce. This department also approves it and is of the opinion that the recommendations should be embodied in law at the ensuing session of the Congress.

#### THE ALASKA GAME LAW.

The governor of Alaska from time to time has recommended amendments to the Alaska game law. Some of the objects desired could be, and have been, accomplished by regulations prescribed by the de-



partment under existing law; others require action by the Congress. The department concurs in the following suggestions made by the governor and recommends legislation to give them effect: (1) That protection be withdrawn from brown bears. These are a menace to the sheep and cattle industries in Alaska and are so abundant as not to need further protection. (2) That the exportation of walrus ivory be wholly prohibited. This is essential to the preservation of the walrus, which forms an important source of food and clothing for the natives. The present restrictions upon the killing of this animal have proved inadequate to conserve it. (3) That nonresidents be required to obtain licenses to hunt deer and goats, as in the case of other big game. This is necessary for the proper supervision of hunting in the Territory. (4) That residents of Alaska be permitted to obtain two \$10 and two \$5 shipping licenses in each year. It is a useless hardship to restrict them to one of each of these licenses when under the law they may have more than one head or trophy of the animals they wish to ship. There may be ambiguity in the law. If so, it should be removed. (5) That residents of Alaska who wish to have specimens of big game mounted be permitted, without charge, to send them to the States to be mounted and returned. (6) That game wardens be authorized to procure warrants for the search of premises where game killed in violation of law may be secreted.

#### TOBACCO STATISTICS.

During the year the present methods employed by the Departments of the Treasury, of Commerce, and of Agriculture in collecting tobacco statistics were considered by an interdepartmental committee. Its task was to devise a plan to eliminate duplication of work and unnecessary expense and to make the statistics more complete and more easily available to the public. The committee submitted three recommendations, which have been approved by the departments concerned. The first two require congressional action.

(1) That the act of April 30, 1912 (37 Stat., 106), authorizing the Bureau of the Census to collect tobacco statistics, be repealed, and that hereafter that bureau gather only such facts about tobacco as are incidental to the decennial census of agriculture and the quinquennial census of manufactures.

(2) That authority be given to the Bureau of Internal Revenue to extend the statistics collected by it to include the principal types



of tobacco held by dealers at the end of each quarter, and by manufacturers at the end of the year, and to publish this information as quickly as possible.

(3) That an annual report be prepared by the Bureau of Crop Estimates, which shall contain in elaborate form all the statistical information concerning tobacco collected by the Federal Government. The Department of Agriculture is authorized by existing law to publish reports relating to tobacco.

The proposed action would result in economy and efficiency in the collection of tobacco statistics. A single report assembling all information collected by the Government relative to the tobacco crop would be of greater value than are the present separate fragmentary reports.

#### THE STATES RELATIONS SERVICE.

Under the plan of reorganization of the department, approved by the Congress at its last session, the States Relations Service has been created. It has general charge of the department's business with the State agricultural colleges and experiment stations and also of certain related functions. It administers the Federal laws relating to the experimental and extension activities of the State institutions and coordinates them with the work of the department.

#### THE AGRICULTURAL EXTENSION ACT.

The cooperative extension act of May 8, 1914, provides for a nationwide system of instruction for the farming population in agriculture and home economics outside of the schools and colleges. It establishes a close copartnership between the Federal and State agencies in the organization and administration of the extension service. The department is under obligation not only to contribute to the formulation of plans of work which are to be mutually agreed upon but also to assist the colleges in executing them in the most efficient manner. The law contemplates a unified extension organization in each State which will represent and be responsible to both the college and the department.

*The first year's operation.*—During the year much has been accomplished toward creating and perfecting the administrative machinery. All the States have assented to the provisions of the act. One college in each has been designated to receive and to administer the

funds. In several States where the land-grant institution is not coeducational an arrangement for the conduct of the work in home economics has been made with a college for women. In a few States having separate land-grant colleges for negroes a similar plan for extension work among people of that race has been adopted.

The institutions have created separate divisions or services and have brought under them all extension work in agriculture and home economics. Some of these divisions are not yet as clear-cut as they should be. In some cases laws or general administrative regulations adopted years ago have continued a confusing union of the extension organization with the experiment station. In 36 States a separate officer is in charge of the work, usually with the title of director; in 9, this officer also is head of the experiment station or of the college of agriculture.

The general lines of the extension system for the whole country have been well marked out. They embrace (1) the county agricultural agents, (2) the boys' and girls' clubs, (3) the movable schools, and (4) the supporting work of the college and department specialists.

*The county agent.*—The colleges have accepted one of the fundamental features of the system developed by the department prior to the passage of the extension act. The experience of the last 12 years has demonstrated fully the value of the county agent as a means of bringing to the people on their farms and in their homes the results of practical experience and scientific research. There is general agreement that nothing is more important than the establishment in each county of permanent headquarters, in charge of a competent agent, who shall serve as the joint representative of the local community, the agricultural college, and the department. Through this arrangement the needs of the several communities can best be determined and the help of the State and the Nation most speedily and effectively rendered. A large part of the extension funds derived from all sources, Federal, State, and local, have been devoted to the maintenance and development of the county-agent system. There are now more than 1,000 counties which have men as agents, of whom 680 are in 15 Southern States, where there are also 355 women employed. On the whole, these agents have been very successful in securing the support and confidence of the people; and the tangible results of their work are encouraging. The personality

of an agent is a large factor in determining his success. Understanding of the real problems of the region, sympathy with the people, ability to meet them on their own ground and to convey practical instruction in a convincing way, studious inclinations and habits, and business ability of a high order are essential.

*County organizations.*—As the agent can not deal altogether with individual farmers, the problem of the organization of groups of farm people through which he may work is assuming great importance. Two general types exist. County associations, often called farm bureaus, have been formed. These are expected to take the initiative in securing local financial support for the agent, to join in his selection and appointment, and to stand behind him in his efforts to advance agricultural interests. Many of them include business and professional men as well as farmers. Their complex form has given rise to special problems. It is very apparent that, while the cordial sympathy and support of all classes are very desirable, the farmers themselves should control and in the end determine the character and functions of the organizations. Another type is the small community club. When a considerable number of these clubs exist in a county they have been confederated to form a county organization. The exact relations of both types to the extension system have not been fully defined; and they still must be considered as in the experimental stage.

*Work of county agents.*—The work of the county agents is highly varied. In the 15 Southern States during the year direct demonstrations were made on 105,000 farms and instruction was given to 60,000 boys and 50,000 girls. Approximately 500,000 visits were made. The demonstrations covered practically every phase of southern agriculture. Nearly 3,000 silos were built under the direct instruction of the agents and 13,000 pure-bred animals were purchased for breeding purposes. Under the direction of specialists, the agents assisted in hog-cholera control by organizing farmers and instructing them as to the administration of serum. In demonstrating the method, they inoculated 118,000 hogs. They also assisted in organizing communities for the prevention of other animal diseases and vaccinated 26,000 head of stock to show how such maladies as blackleg and anthrax might be combated. They aided department employees in tick eradication and were instrumental in securing the



construction of 2,000 dipping vats. Many creameries and cream routes were established, and instruction was given in the feeding of dairy cattle and the marketing of milk.

More than 75,000 hillsides were terraced to prevent erosion. On thousands of farms the stumps were removed to permit better cultivation. Approximately 65,000 acres were drained. Nearly 3,000 demonstration home gardens were planted, and farmers were induced to purchase 132,000 improved implements. About 500 communities were organized and engaged cooperatively in some special work, such as breeding of live stock, purchasing and selling, handling of seed, and marketing of crops, and the improvement of farm practices. Many of these not only handled financial matters but also interested themselves in the social, educational, and rural betterment of the neighborhood.

The women county agents inaugurated work for women. Home conveniences, eradication of flies and mosquitoes, proper preparation of food, care of poultry, and marketing of eggs received attention. Approximately 50,000 homes were visited and given helpful suggestions, while 6,000 farm women made special demonstrations in home improvement.

In the Northern and Western States, where the work is comparatively new, the number of agents increased during the year from 219 to 350. These agents were instrumental in forming 875 local organizations, including farmers' clubs and associations for improvement of crop production, breeding of live stock, cow testing, and purchasing and marketing. They conducted 35,000 demonstrations with crops and live stock. They visited 76,000 farms, addressed meetings attended by 1,200,000 people, and assisted in developing agricultural instruction in 4,600 schools. About 72,000 farmers and their families attended short courses or movable schools. On the advice of agents 600,000 acres of tested corn, 280,000 acres of oats, 17,000 acres of potatoes, and 85,000 acres of alfalfa were planted. Approximately 2,000 registered sires were secured for farmers; 300,000 hogs were vaccinated for cholera; 2,000 farmers were instructed in the mixing of fertilizers, and 11,500 conducted demonstrations in the use of lime; more than 2,000 were assisted in keeping farm accounts, and, through exchanges organized by the agents, 2,300 were supplied with labor.



*Boys' and girls' clubs.*—Another important activity developed by the department and the agricultural colleges prior to the passage of the extension act and continued under the new machinery is the boys' and girls' club work. In the Southern States this undertaking is associated with the county-agent system; in the other States it is conducted independently. Through it the extension agencies are brought into close touch with the State and local school officers and teachers, who cooperate in the formation and management of the clubs.

In the Southern States 110,000 boys and girls were enrolled during the year. Among their activities the following are of special interest: Of the 60,000 boys, many were interested in growing winter legumes for soil improvement. Four-crop clubs were formed in some of the States, with rotation on 3 acres of ground, to show the financial advantage of improving soil fertility. Many of the boys were organized into clubs to raise pigs and poultry. Fifty thousand girls were enrolled in the canning clubs. They were taught to make home gardens and to preserve for home use the garden products as well as the waste fruits and vegetables of the entire farm.

In the Northern and Western States the enrollment of boys and girls was more than 150,000. The leading club projects were the growing of corn and potatoes and garden and canning work. Through these clubs, work in crop rotation, soil building, and the proper distribution of labor and enterprises throughout the year was undertaken by the boys and girls. Many members are working out three and four year rotations of crops and are spending their net profits in the purchase of pure-bred stock, hogs, poultry, sheep, and labor-saving machinery for both farm and kitchen. Numbers of them are buying land, thus early acquiring the habit of thrift and the sense of the dignity of land ownership. At 938 public demonstrations in the home canning of fruits and vegetables 118,000 persons were in attendance, including more than 50,000 women and 10,000 men. Of the 1,557 club members who attended the midwinter short courses at the colleges of agriculture, 968 had their expenses paid by the local people, institutions, or organizations as a recognition of their achievements.

*Extension specialists.*—The agricultural colleges for many years have done a large amount of extension work through the members of their faculties and the experiment-station staffs. At first this was

purely incidental; but as extension activities have grown a more definite share of the time of specialists has been devoted to the work. More recently in some institutions certain officers have been assigned wholly to this service. These officers are expected to supplement the field work of the county agents, to furnish them advice and assistance, to give short practical courses of instruction, to conduct demonstrations along special lines, to prepare publications, to address meetings of farmers, and to answer inquiries. In general, it is their duty to gather up the available information in their several specialties, and particularly that of the State experiment stations, to put it into effective form, and to furnish it to farmers directly or through the county agents.

Specialists also are sent out by the department to work with the extension agents. Among these, for example, are specialists in dairying, animal husbandry, the use of hog-cholera serum, tick eradication, marketing of agricultural products, farm management, and the home canning of vegetables and fruits.

*Funds for extension work.*—For the current fiscal year the department funds available for this purpose aggregate \$1,200,000. Under the extension act \$1,080,000 is allotted to the States. The total Federal contribution thus amounts to \$2,280,000. This is met by approximately \$2,653,000 from the States. The latter includes \$600,000 to offset the equivalent allotment of extension-act funds, \$499,000 from additional State appropriations, \$333,000 from college funds, \$944,000 from counties, and \$277,000 from local organizations and miscellaneous agencies. The total from both Federal and State sources is, in round numbers, \$4,933,000. Of this sum about one-half will be expended in the demonstration and other activities of the county agents. Much of the work done by these agents bears directly on farm-home problems, but \$550,000 has been allotted for distinctive instruction in home economics. Nearly \$300,000 has been allotted specifically for activities among boys and girls, and yet this sum does not represent the total which will be used in extension work among young people. Approximately \$1,000,000 will be devoted to the tasks of the specialists.

This general review of the national cooperative extension system shows that under the stimulus of the Federal act forces previously in operation have been strengthened and that altogether the movement for the practical education of the rural people has been broadened.

*Direct extension funds.*—The appropriations made directly to the Department of Agriculture very largely are expended in developing the county-agent system. Contributions to the salaries of the agents are made on a plan which encourages local support. The system is well established in about one-third of the counties. This result has been attained mainly because the department has supported actively the movement during the period when the people were not fully persuaded of its value. Two-thirds of the counties have not yet placed the system on a permanent footing and need the stimulating influence of the department and of the State college. The work in home economics as yet is in its inception. It is highly desirable, therefore, that the department have direct appropriations available for extension work. As Federal and State funds become sufficient to maintain all the agents, it may be desirable for the department to decrease gradually its contributions and to expend its appropriations more largely for the support of administrative officers and specialists who shall supervise the work of the agents, supplement their activities by special demonstrations, and give expert advice and assistance.

#### THE NATIONAL FORESTS.

Nearly 25 years have passed since the first public timber reservation was made and 10 since the National Forests were put under the Department of Agriculture. Sufficient time has elapsed to determine whether their creation was wise.

The principal purpose in establishing the Forests was to secure sound economic and industrial development. Experience had shown that private ownership of large areas of timberland in most instances involved a sacrifice of public interests. Many private investments in forest lands are made for the mature timber and not for the purpose of growing new tree crops. The long time required to raise a merchantable product, the risk of loss from fire and other destructive agencies, the fear of burdensome taxes, and the uncertainty of market conditions usually make the holding of cut-over lands unattractive to capital. Hence, the peculiarly public character of the problem of forestry.

*Fire protection.*—Before the National Forests were created practically no effort was made to protect the timber on public lands from destruction by fire, notwithstanding the fact that the situation was peculiarly hazardous. During the last decade a fire protective sys-



tem has been developed. Extensive improvements have been made, including more than 25,000 miles of roads, trails, and fire lines, 20,000 miles of telephone lines, many lookout stations, and headquarters for the protective force. In the year 1914, when conditions were exceptionally unfavorable, nearly 7,000 fires were fought successfully. They threatened bodies of timber valued at nearly \$100,000,000, but the actual damage was less than \$500,000. This work not only is saving public property; it is conserving the material for local economic development and for permanent industry. Furthermore, the results of the Federal system have induced many States to take up the work, and active cooperation between the two agencies has followed.

*Use of timber.*—The service rendered by the National Forests is not confined to protection from fire. The resources are being utilized to build up the country. They furnish the timber required by settlers, communities, and industries within and near their borders. This is obtained without charge by settlers, prospectors, and other local residents for personal use; at cost by settlers and farmers generally for domestic purposes; and at market value by individuals or corporations desiring to purchase it. During the last 11 years the number of permits for free timber to settlers has been multiplied 13 times and the number of sales 27 times. The amount cut annually by settlers under these permits is more than four times what it was in 1905, while that under commercial sales has increased eightfold. In the three years since sales at cost to settlers and farmers were authorized by the Congress their annual volume has increased enormously. Nearly 51,000 lots were disposed of during the last year. Probably not less than 45,000 persons or corporations obtained timber directly from the National Forests.

More than half of the timber now cut annually is used in the vicinity of the Forests. This includes all that taken free and under sales at cost, and approximately 45 per cent of the commercial cut. Hundreds of mining districts throughout the West, from small projects requiring an occasional wagonload of props or lagging to the great copper district of central Montana, which consumes about 380,000 pieces of mining timber annually, are supplied. Railroads also are furnished a large part of the ties and other material required for their lines in the Rocky Mountain regions. A million and a half ties now are cut from

the Forests yearly. Throughout the West timber is taken from them for near-by towns, irrigation projects, hydroelectric power plants, and the like, while thousands of individual settlers obtain it for fuel and farm improvements. On the Alaskan coast the salmon packers, towns, and settlers use 40,000,000 feet a year from the Chugach and Tongass Forests.

The National Forests also meet the demands of the general lumber market. More than 300,000,000 feet are cut annually for the nationwide trade. Since 1908 there have been taken from them 5,000,000,000 board feet of wood and timber products.

Not only is timber amply supplied and are future resources safeguarded, but the ultimate damage to the West through impairment of its water resources, vitally important for irrigation and other purposes, also is prevented. The damage would have been of a kind to force at a huge cost the undertaking of protective works against erosion, torrent formation, and floods. Other countries have been compelled to do this. At the time the National Forest policy was entered upon the agencies making for destruction were actively at work. A range overgrazed and forest fires which burned unchecked were diminishing the water-storage value of the mountains and accelerating soil destruction and removal. The evils averted and the benefits secured through only a decade of protection and regulated use constitute a gain of great moment.

*Grazing.*—Although the National Forests were established primarily to conserve the timber and to protect the watersheds, it has been the consistent aim of the department to develop all other resources. Grazing, mining, agriculture, water power, and recreation all are fostered. One of the most important of these is grazing. The greater part of the summer range in the Western States is in the Forests. Under the regulated system the forage is utilized fully, without injury to the tree growth and with adequate safeguards against watershed damage. There were grazed last year under pay permits 1,724,000 cattle and horses and 7,300,000 sheep and goats. Several hundred thousand head of milch and work animals were grazed free of charge, and more than 3,500,000 head of stock crossed the Forests, feeding en route, also free of charge. Not including settlers who have the free privilege or persons who have only crossing permits, there are 31,000 individuals who have regular permits. During the year ended June 30, 1905, there were only 692,000 cattle and horses

and 1,514,000 sheep and goats on 85,627,472 acres. The number of animals now sustained in proportion to the area of the Forests is 50 per cent greater than it was 10 years ago. Since 1905 the number of persons holding grazing privileges has increased nearly 200 per cent. This is due in part to the enlarged area of the Forests, but can be attributed principally to wider use by settlers and small stockmen. When the regulated system was established the Forest ranges, like the open public lands to-day, rapidly were being impaired. The productivity of the land for forage in most places has been restored and everywhere is increasing; the industry has been made more stable; stock comes from the Forests in better condition; range wars have stopped; ranch property has increased in value; and a larger area has been made available through range improvements. It is probable that 100,000,000 pounds of beef and mutton are sold each year from herds and flocks occupying the ranges. That the Forests have promoted the development of the stock industry is indicated. This is appreciated by stockmen and they are urging that a similar system of range regulation be extended to the unreserved public lands. But it is not merely the stock industry that has been benefited. The grazing privilege has been so distributed as to promote healthy community growth, increase settlement, prevent monopoly, and diffuse prosperity. In other words, public control has served social as well as economic ends.

*Water power.*—The National Forests contain approximately one-half of the water power of the West. The department for nearly a decade has been issuing permits for its development. Unfortunately, the present law does not authorize the granting of permits for fixed periods. It should be amended, and recommendations to this end have been made repeatedly by the department. While authority to grant term permits undoubtedly would aid water-power utilization, the fact remains that development, practically to the extent of the market, actually is now taking place on the Forests. In the Western States power development has advanced proportionately very much more rapidly than in the East, where land is privately owned. The amount of water power used in the generation of electricity by public utilities corporations, street railway companies, and municipalities has in the last decade increased 440 per cent in the West, or more than twice as fast as in the remainder of the country. There, in proportion to population, four and one-half times as much water power



is used as in the remainder of the United States, and nearly three times as much as in the Eastern States.

Of the existing 1,800,000 water horsepower in the Western States, 50 per cent is in plants constructed in whole or in part on the Forests and operated under permit from the department. Plants under construction will develop about 200,000 additional horsepower, while over 1,000,000 more is under permit for future construction. The chief obstacle to further immediate water-power expansion is the lack of market, for plants in operation in the West now have a surplus of power of which they can not dispose.

*Mining development.*—The National Forests are open to prospecting and the initiation of mineral locations just as is the open public domain. When a mineral claim comes up for patent it is examined on the ground to discover whether the terms of the mining laws have been complied with. This examination is designed to prevent fraud, and no one with a valid claim need fear it.

The existence of the Forests gives certain advantages to the miner. It is not on the great private timber tracts in the western mountains that the miner is prospecting. It is only on the Forests and other public lands open to mineral locations, if he makes a discovery, that he can get title merely through conscientious compliance with the mining laws. Many mines to-day are securing their timber from the Forests, and because of its protection and continued production a steady supply at reasonable rates is assured.

*Recreational uses.*—The National Forests are used also for health and recreation. They embrace the high, rugged mountains of the West, the scenery of which is unsurpassed. These great areas are open to the whole Nation. Already more than one and one-half million people visit them annually for recreation, and this number is increasing rapidly as roads and trails are built, making new points accessible. The lands bordering on the hundreds of lakes and streams in the Forests offer attractive sites for camps and for permanent summer residences. Authority now exists to grant term leases for the erection of summer homes, hotels, and similar buildings, and large numbers will take advantage of this privilege. Public ownership has protected the natural beauty of these areas. Their recreational value has been maintained and increased through road and trail construction and through intelligent study of the needs of the public.

*Importance to agriculture.*—To the agricultural interests of the West the proper handling of the Forests is of great importance. The Forests conserve and increase the supply of water. Fire protection gives property an added value, as do roads, trails, and other Government improvements. In fact, the existence of the Forests gives a permanence to agriculture that does not exist where the timberlands are privately owned.

What has happened in the older lumber regions of the country is well known. The scattered agricultural areas were occupied as long as the timber lasted and lumbering operations furnished markets, kept up roads, and gave employment when the farm could be left. But with the exhaustion of the timber, the devastation of the lands by fire, the abandonment of the logging roads, and the moving of the industry to some new region, the farms, too, were abandoned and whole townships depopulated.

*Agricultural settlement.*—It is the department's policy to make available for settlement all lands which are chiefly valuable for farming. In order to open such areas a careful classification is being made. Large tracts found to be valuable for agriculture or unsuited for permanent Forest purposes are eliminated. During the last five years about 14,000,000 acres have been released. In addition, individual tracts are classified and opened to entry upon application of home seekers. Since the work was begun more than 1,900,000 acres have been made available for the benefit of 18,000 settlers.

In short, lands within the Forests really adapted to agriculture are being occupied as homesteads under favorable conditions. While the lands suited to settlement are classified and opened to entry, those which are not chiefly valuable for agriculture are retained in public ownership. The alienation of timberlands under conditions that will lead not to settlement but to speculation and to increasing the holdings of private timber owners would defeat the very purposes for which the Forests were established.

The real agricultural problem within and near the Forests is to make possible the successful occupancy and development of the lands that already have been opened to entry or actually patented. The mere private ownership of land does not insure successful use of it. In Oregon and Washington alone there are about 3,000,000 acres of logged-off land, much of it agricultural in character, now

lying idle. In this condition speculative holding of the land for higher prices plays a large part. Another cause is the lack of transportation facilities. A settler may clear land and raise crops upon it, but he is helpless if he can not market them. There are great areas of fertile land unused to-day on this account. In many sections near the National Forests pioneer conditions still exist. The population is small and the task of road building is beyond the means of the residents. There is little or no demand for timber and the receipts from the Forests which go to the community are small. The fact that the public property is not subject to taxation makes such communities feel, and very justly, that the Forests are not contributing enough to local development.

This situation should be changed. Assistance should be given in the building of roads to bring into productive use the resources of such regions. Therefore the suggestion contained in the last annual report is repeated, that upon a showing of public necessity appropriations be made for specific roads and similar improvements, to be charged against the State's future share of receipts from the Forests. Such action would promote the local development of agriculture and other resources.

To secure the maximum use of the lands still remaining in Federal ownership further legislation is needed. There must be a constructive program which will promote development and safeguard public interests. The aim should be to make these properties more useful, available to greater numbers, and effectively instrumental in building up industries.

*Eastern forests.*—The wisdom of retaining the western forests under national control is indicated by the course which the Federal Government has found necessary in dealing with the mountain lands of the East. These lands passed into private hands directly from the States. Their present condition furnishes an example of what happens when mountain lands are controlled by individuals. The results became apparent years ago. Erosion, loss of the soil, and clogging of streams with silt and stone followed the removal of the timber. Stream flow became more irregular and great losses resulted to property through increased floods.

So serious was the situation that it was brought to the attention of the Federal Government as early as 1900. Various methods of handling the problem were proposed and discussed, but it became



apparent that the Government must purchase and control the more strategic areas. With this end in view the act of March 1, 1911, established a National Forest Reservation Commission and authorized it and the Department of Agriculture to proceed with the acquisition of lands at the headwaters of the navigable streams. It was necessary in the East to acquire by purchase the same class of lands which in the West were put into National Forests merely by proclamation. An appropriation of \$11,000,000 was made for these purchases, to be expended during the fiscal years 1910 to 1915. It has not been practicable to use the entire sum; a portion lapsed before contracts of purchase could be completed. The commission has approved the purchase of lands in 16 localities of the southern Appalachian and White Mountains, involving a total area of 1,317,551 acres. This has been acquired or bargained for at an average price of \$5.22 per acre.

The funds made available under the first appropriation are nearly exhausted. In its report to the Congress for the fiscal year 1914 the commission recommended that purchases be continued until about 6,000,000 acres shall have been obtained and that the Congress authorize appropriations through another five-year period at the rate of \$2,000,000 a year.

As fast as the eastern lands are acquired they are placed under an administration similar to that of the western forests. Already on these lands, of which 348,275 acres had been paid for on June 30, 1915, headway has been made in overcoming fires and in starting the Forests toward increased productiveness. Situated for the most part near densely populated communities, the resources of these lands are readily available. There is immediate need for their timber, mineral, water, and forage resources and also for their development as recreation grounds. Purchases should continue until areas sufficient to be influential in protecting the region are acquired.

*Alaska forests.*—Two of the 155 National Forests are in Alaska. The Tongass comprises approximately 15,000,000 acres in southeastern Alaska, while the Chugach, covering the timbered area about Prince William Sound and thence westward to Cook Inlet, contains about 5,500,000 acres. Most of the timber on them is of the coast type, Sitka spruce, hemlock, and cedar being the predominant species. On the Tongass single spruce trees not uncommonly reach a diameter of 6 feet, a height of 200 feet, and a yield in merchantable material of 20,000 board feet. Limited areas carry 100,000 board feet to the acre,

and 40,000 to 50,000 feet over considerable areas is common. The timber is accessible, of excellent quality, comparatively easy to log, and close to water transportation. The presence of available water power will facilitate the development of wood-using industries. While the Chugach Forest has less favorable conditions for timber growth and a less heavy stand than the Tongass, nevertheless in it there is a large amount of merchantable Sitka spruce and hemlock, which will have an increasing importance for railroad construction, mining, and other industrial purposes. Large areas have an average stand of 15,000 to 20,000 board feet to the acre; and the best run as high as 50,000 feet. The volume of timber on the two Forests is estimated to be between sixty and eighty billion board feet, about one-eighth of the total estimated quantity on all the Forests.

In accordance with the general principle of organization adopted for all the Forests, but to a greater degree than elsewhere because of their remoteness, the administration of the Alaska Forests is decentralized to permit the prompt transaction of business and ready response to the needs of the public. Aside from matters pertaining to the alienation of land, about 98 per cent of the business of the two Alaskan Forests is handled by the local force.

Approximately 40,000,000 feet of timber are cut annually under sales. Settlers secure free, without permits, the timber needed for personal use. Mining locations are made as on the public domain. Agricultural land is classified and placed at the disposal of settlers. Every encouragement is given to the use of lands for miscellaneous purposes. In some places there is an increasing use of land for canneries, stores, and other enterprises. As a rule these localities are not yet in a position to incorporate as towns and to take advantage of the town-site laws. It would be a public benefit if authority were granted to permit the sale of such lands after examination and classification by the department. Definite provision, however, should be made against alienation of those which are chiefly valuable for water-power sites or are needed for handling the timber resources or for other public purposes.

The Alaska National Forests are designed to serve the same broad public purposes as the Forests in the States. It is the aim to administer them in a spirit of service to the people who are struggling to build up communities and homes and to establish industries.

They should be preserved and should continue to be administered in connection with the other Forests of the Nation.

I have been compelled in this, as in previous annual reports, to confine myself to certain topics. It would be impossible within reasonable limits to review much of the important work of the different bureaus. Only by careful study of the separate reports of the chiefs can one form any satisfactory idea of the extent, variety, and nature of the problems which the department is attacking.

Respectfully,

D. F. HOUSTON,  
*Secretary of Agriculture.*

THE PRESIDENT.





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REPORTS OF CHIEFS.

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## REPORT OF THE CHIEF OF THE WEATHER BUREAU.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
WEATHER BUREAU,  
*Washington, D. C., September 22, 1915.*

SIR: I have the honor to submit a report of the operations of the Weather Bureau during the fiscal year ended June 30, 1915.

Respectfully,

C. F. MARVIN,  
*Chief of Bureau.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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The daily work of the Weather Bureau is an important public service, and every branch of commerce, industry, and business activity is continually finding new ways in which the information obtainable from Weather Bureau sources can aid in the more efficient conduct of those affairs. The 200 principal stations of the Bureau, well distributed throughout the country, form intimate points of contact between the central organization and those it aims and desires to serve. These stations not only collect and report telegraphically the local meteorological condition, but also serve simultaneously the equally important purpose of a local center for the dissemination of every species of weather news. Forecasts, storm, frost, flood, and other warnings and weather bulletins to be of real value must be immediately disseminated. The Weather Bureau is well organized to accomplish this result, and its work and efforts are impaired on some occasions only by the failure or complete interruption of the customary means of communication—that is, principally, the telegraph and telephone service.

Almost the first effect of great floods and destructive storms is to cut off communication by the customary wire service. Wireless methods of communication are subject to but little, if any, interruption by destructive weather conditions, and on such occasions are often the only means of communication that remain. A powerful argument is found in these considerations for the establishment of wireless stations in many regions of the country, especially those that have repeatedly suffered from disastrous floods and storms and the serious loss of communication with the outside world.

The funds appropriated by Congress for the work of the Bureau have remained practically the same for several years, in fact, have suffered slight reductions. The service has, however, been extended in many directions by increasing the distribution of frost warnings, extending the river and flood service, the introduction of fire-wind forecasts for the better prevention of forest fires, the enlargement and publication in better form of weather and crop bulletins, and the

monthly reports of climatological data. These improvements have been accomplished without additional expenditures by economies of administration and efficiency of organization.

The Bureau is in receipt of applications from many sections of the country for extensions of its service. These include requests for river and flood warnings, frost, and cold-wave information; fruit, tobacco, trucking, and vineyard protective work, and water resources information in the sparsely occupied region of the West, where the whole region is as yet but poorly covered with reporting stations. Extensions of the grain, cotton, sugar, rice, and other crop region services are also necessary.

The increases needed represent a normal and legitimate response to the natural growth, development, and extensions of the several industries and activities of the country and are necessary to meet a natural increase in the use that is being made of the Weather Bureau service. The commercial as well as the naval and military interests of the country fully justify the improvement and extension of the work of the Bureau in the Panama Canal and the region of the Caribbean Sea. The changing conditions in Alaska likewise claim attention. In a few words, all the foregoing means increased service. That means more reports, more warnings, more telegraphing, more equipment and general supplies, and additional men.

The details of the work of the Bureau during the past year are briefly discussed under separate topics, as follows:

#### STATIONS AND OBSERVATIONS.

No increase has been made in the number of principal or fully equipped stations, which is now 197. A substation previously maintained at Wausau, Wis., for the special purpose of a flood-warning service in this section, has been manned by a commissioned employee of the Weather Bureau, as no other satisfactory arrangement could be made to continue the station, and funds are needed for its full equipment.

#### OBSERVATORY BUILDINGS AND STATION OFFICES.

Two new Weather Bureau Observatory buildings, authorized prior to July 1, 1914, were completed and accepted; that at Sandy Hook, N. J., on August 29, 1914, and the one at Cincinnati, Ohio, on February 22, 1915. The latter is practically the first suburban meteorological observatory established by the Weather Bureau and happens to have been most appropriately placed at Cincinnati, where our present meteorological service may be said to have started in 1869 and 1870, under the initiative of Prof. Cleveland Abbe. Advantageously located on elevated ground in the north part of the city, in Clifton suburbs, it should prove of exceptional value for meteorological work and a permanent place at which such work may go on under favorable conditions for many generations to come. The present down-town station in the Federal Building, in or near which the Weather Bureau station was situated for nearly 45 years, is also to be maintained as a printing and business office.

Contract has been let for the new cottage building and telegraph office authorized by Congress at the Neah Bay (Wash.) station on the Weather Bureau seacoast telegraph line, near Tatoosh Island. Construction work will be taken up promptly.

Necessary repairs and improvements have been carried to completion on Weather Bureau buildings and grounds at Atlantic City, N. J.; Bismarck, N. Dak.; Modena, Utah; North Platte, Nebr.; Sault Ste. Maria, Mich.; San Juan, P. R.; and Sheridan, Wyo. The building belonging to the Bureau but occupying leased ground at Kitty Hawk, N. C.—a discontinued station—was disposed of at public sale.

A farm of about 40 acres, with buildings complete, was leased at Drexel, Nebr., for a new aerological station at which to maintain and continue the kite and balloon work, transferred thereto from Mount Weather.

The building in which the Weather Bureau occupied rented quarters at Jacksonville, Fla., was partially destroyed by fire January 3, 1915, involving a financial loss to the Government for station equipment of about \$2,500.

To secure suitable conditions for obtaining accurate observations of weather conditions at its outlying stations, offices are located in Federal buildings wherever suitable quarters may thus be had. Where these are not available nor suitable, rented offices are utilized or, in a number of cases, the Weather Bureau has erected observatory buildings of its own. At the end of the fiscal year there were 45 of these latter, in addition to the central office building in Washington. The accumulated investment for these permanent structures outside of Washington amounts to about \$1,000,000 for grounds and property as a whole.

The following statement gives the status and number of Weather Bureau station offices in operation on June 30, 1915:

Free quarters and accommodations:

In Federal buildings.....	64
In State or other public buildings.....	7
In Weather Bureau observatory buildings.....	45
Total free of rental.....	116
In rented quarters owned by individuals or corporations.....	98
Total for entire service.....	214

SUBSTATIONS.

A few extensions have been made in the work conducted in the interests of the grain, cotton, sugar and rice, cattle, and such industries, notably in the frost-fruit work in the Salt River Valley of Arizona, the Rogue River Valley of Oregon, in the vicinity of Walla Walla, Wash., in southern California, and in the large fruit districts of Ohio.

Two new special meteorological stations were established in Alaska in cooperation with the naval radio service.

The large corps of cooperative observers, now more than 4,500, was further increased during the year by the opening of more than 100 new stations at points from which meteorological data will be useful in determining the climate of the country. The large amount of data collected by these observers, on the whole, was presented in excellent form, and shows a conscientious desire on their part to render the best service possible.

The proper exposure and care of instruments, as well as the correct interpretation of their indications by observers at substations and



the prompt rendition of reports, are fully appreciated, and effort has been made to attain the highest possible degree of accuracy in these respects. To best accomplish this, however, it is imperative that a more frequent inspection of these stations be provided for. A personal visit to the observer enables the section director to acquaint himself with the general environment of the station, to remedy defects in the exposure of instruments, where such exist, or in the manner of recording the observations, and also encourages the observer to renewed efforts if he has become discouraged at an apparent lack of interest in the work. It is also believed that in the establishment of new cooperative stations the equipment should be installed and the observer instructed whenever possible under the personal supervision of a trained Weather Bureau official.

#### SNOWFALL AT HIGH ALTITUDES IN WESTERN STATES.

The Weather Bureau for some years past has sought to determine in the spring of each year the probable amount of water contained in the snow cover of the higher levels that may later be available for irrigation and other purposes.

The project is a difficult one because of the fact that, as a rule, the higher altitudes are either not inhabited, or, in many cases, only during the summer months; hence, with the exception of the low passes occupied by the continental trunk lines of railroad and a few isolated points where mining camps are located, comparatively little is known of the total amount of the winter snowfall. The total number of high-altitude snowfall stations is gradually becoming less and less, due to the abandonment of mining camps and other enterprises that have been hitherto maintained throughout the year at high altitudes. The present method of obtaining observations of the winter's snowfall through persons who may reside on the higher altitudes throughout the year has reached the limit of its development. On the other hand, the plan of intensive surveys in small watersheds, as developed originally by Thiessen, promises relatively valuable results, but of extremely local application. Three such surveys were made during the current year, as follows: One in City Creek watershed, near Salt Lake City, Utah, at elevations ranging from 8,500 to 9,500 feet above mean sea level; a second in the watershed of Cottonwood Creek, a tributary of Boise River, that joins the main river a short distance above Arrowrock Dam; and the third by the Rock Creek Conservation Co., in cooperation with the Weather Bureau, in the watershed of Sand Lake, Carbon County, Wyo., at altitudes of between 10,000 and 10,500 feet above mean sea level.

All of these surveys were conducted in fairly accessible regions, the plan being to pack supplies, implements, and tent equipage to some convenient base, go into camp at that point, and make daily journeys thence into the snow fields. The greatest objection to this plan is the time consumed daily in going to and returning from the snow fields. Where it is possible to transport supplies and material into the heart of the snow fields, as was done in the City Creek project, much advantage is secured.

The survey in the watershed of City Creek, in 1915, whence Salt Lake City draws its water supply, showed 30 per cent less water in the snow cover than in the previous year, and also that the snow was in a condition favorable to early melting.

The survey in Cottonwood Creek was conducted under very favorable conditions. In the first place, the entire watershed of but 26 square miles had been previously surveyed by the United States Geological Survey, and in the second place, it was possible to measure accurately the run-off from the watershed during the snow-melting season. The results are not yet at hand, but in this connection it may be remarked that a snow survey in this watershed during the previous year brought out the fact that the run-off from snow was remarkably small. This result, it may be remembered, agrees with the conclusions reached at Wagon Wheel Gap, Colo., at the experiment station being conducted jointly by the Forest Service and the Weather Bureau.

An extension of the snowfall work to the watershed of Salt River in Arizona is of sufficient importance to merit separate mention.

#### SNOWFALL IN SALT RIVER WATERSHED.

The demand for information as to the probable amount of snow water available for irrigation purposes on the watershed of the Salt River of Arizona, above the Roosevelt Reservoir, made itself felt several years ago.

Considering that one of the most important reclamation projects under the supervision of the Federal Government centers in the Salt River Valley of Arizona, it was deemed advisable to spare no effort toward acquiring the information sought. At that time it was known in a general way that the most representative snowfall tract in the watershed of the Salt River above the Roosevelt Reservoir was in the Apache Indian Reservation, north of Fort Apache, in the mountain district of the North Fork of White River, a tributary of the Salt. That country was, however, almost an absolute terra incognita as far as topographic maps are concerned. The first endeavors were therefore in the nature of a reconnaissance survey in an effort to construct a rough topographic map of the watershed. A first survey was made in November, 1913, from Roosevelt, Ariz., as a base, the objective being a four days journey by wagon from that point. A few snow-stakes were set up on that journey, but while the original plan was not carried out by reason of severe snowstorms in the latter part of the month, a substantial contribution was made toward mapping the region. In this preliminary survey valuable aid was extended by officials of the United States Reclamation Service, the United States Forest Service, and by officials and agents of the United States Indian Service.

Such stakes as were installed on the first expedition were visited by a second expedition, also in the nature of a reconnaissance survey, in April, 1914. On this expedition the altitude of the snow line was noted and a considerable amount of general information was secured that will be useful for comparative purposes in future years. It was also concluded as a result of the second expedition that the region about Paradise Creek, a tributary of the North Fork of the White River, was the most accessible locality for making permanent measurements of the depth and density of the snowfields in the vicinity of Fort Apache.

The work of 1915 consisted in two attempts to reach Paradise Creek. The last one, made in the latter part of March, 1915, was successful only by completing the last 8 miles of the journey on snow skis after having left the horses and camp outfit on the way. The



expedition naturally was unable to accomplish all that it had set out to do by reason of failure in transportation arrangements. It, however, determined the fact that the snowfall of the winter of 1914-15 in the mountains of eastern Arizona was extraordinarily heavy.

Fortunately for agricultural and other interests in Arizona that depend upon the water supply, the precipitation of rain, as well as snow, during the winter, was abundant. On April 14, 1915, water began to run over the spillway of the Roosevelt Dam, storage capacity in the reservoir being reached in that month, a fact easily foreshadowed by the reliable reports of heavy snow in the mountains that were made at the close of January, 1915.

Much work remains to be done in the mountain regions of extreme eastern Arizona. Indeed, the work thus far accomplished can only be considered as preliminary to a more general campaign.

#### EVAPORATION.

Data on evaporation constitute a term in the climatological factors of any given region that is of very great practical value. However, the amount of evaporation from the free surface of a body of water of greater or less extent, as a reservoir, an irrigating ditch, a lake, or the like, and the evaporation from the surface of soils of various compositions and conditions of vegetal covering, or the absence thereof, also the evaporation from such objects as forests, fields of growing grain, etc., are so different under the same general meteorological or climatological conditions that thus far no satisfactory means of measuring evaporation under the several conditions mentioned have been found. These conditions, perhaps more than any other, have been a barrier to the serious undertaking of definite and long-continued series of observations of evaporation according to some one particular method of measurement, which at the best would probably not entirely meet the requirements of any one of the lines of study in agriculture, engineering, forestry, and the like.

Notwithstanding the foregoing, the Weather Bureau has adopted a standard type of apparatus and inaugurated measurements of evaporation thereby. Moreover, the results of various determinations of evaporation that have been made from time to time, either in the Weather Bureau or in cooperation with other Federal services, or that might possibly be available from independent measurements, are now being collated and prepared for publication in appropriate form. The several types of data thus available, however, are not strictly comparable, principally because there has been lack of uniformity in the methods and apparatus used. In many cases no attempt was made to separate rainfall from evaporation, so that the records are for the most part fragmentary, discontinuous, and more or less unsatisfactory.

While numerous attempts have been made to correlate evaporation with the meteorological conditions prevailing while it occurs, yet no dependable formula is known. Temperature of the water surface is an important factor, and this datum is generally wanting in many of the older records. It thus appears that the direct determination of the rate of evaporation in various portions of the country by actual measurements under standard conditions at stations well distributed is certain to ultimately yield data of very great value.

A model Weather Bureau evaporation station is now maintained at Massachusetts and Nebraska Avenues, Washington, D. C., in co-



operation with the American University. Daily measurements have been maintained since early in April, the total evaporation measured in inches being: April, 6.48; May, 6; June, 6.58; July, 7.05. Another station of the same general character is being established at the Roosevelt Reservoir in cooperation with the Reclamation Service, and arrangements are being made for establishing a number of others.

Detailed instructions for the operation and conduct of stations of this character will be published by the Weather Bureau in the near future.

#### TELEGRAPH SERVICE.

The services performed by the several telegraph and telephone companies in collecting and disseminating weather reports, forecasts, warnings, etc., are fundamental and essential to the work of this Bureau, and, on the whole, have been very satisfactory.

Except for temporary interruptions, the several sections of the coast lines owned by the Weather Bureau were in continuous operation during the year.

The Block Island-Narragansett section has worked with little interruption during the year. A sleet storm on February 3 caused the prostration of a mile of telegraph line on the island. Communication was restored February 7.

CAPE HENRY-HATTERAS SECTION.—Communication was interrupted on this line for a total of 43 days. During these interruptions weather reports from Hatteras were missed but a few times, as they were handled with slight delay by telephone and wireless through the cooperation of the Coast Guard Service and the commercial and Navy wireless stations.

Early in September repairs to the Manteo cable were necessary in order to straighten the cable and close a break caused by the steamer *Trenton* backing into the cable and cutting it in two. The water of the sound in this region is very shallow. November 23, 1914, the Manteo cable was again repaired by Lineman Smith, of the Coast Guard Service, putting in 100 yards of spare cable in place of a portion found defective. The cable, however, continues to work heavy through the south conductor, and in order to work the line through to Hatteras, Manteo at times must be cut off by means of a switch located in the Coast Guard station at Nags Head. This arrangement is not satisfactory, and action to repair or replace the cable must be taken in the near future. General repairs conducted with the aid and cooperation of the Coast Guard lineman were completed in April, 1915. Later two severe storms broke off a number of old poles and left the line in impaired condition. Repairs were again made, however, but new poles and some new wire are still needed.

The transfer office of the line was removed from Norfolk to Cape Henry during July, 1914, and all commercial business in connection with the radio station at Buxton, N. C., and the Western Union and Postal telegraph companies in Norfolk is handled through the Cape Henry office. All city messages for Norfolk are handled direct from Cape Henry by telephone or are telegraphed to the Western Union or Postal offices, where delivery is made without charge to the Government. The arrangement has worked well and all business has been handled promptly and satisfactorily, not a single complaint of any kind having come to the attention of the chief operator.

**VESSEL REPORTING.**—Cape Henry is one of the most important vessel-reporting stations of the service, 19,706 vessels having been reported during the year. Also, 12 wrecks were reported from various Coast Guard and Weather Bureau stations to Cape Henry, from which point the information was given out and assistance dispatched to the scene of the wrecks.

**KEY WEST-SAND KEY SECTION.**—The submarine telephone cable connecting Key West with Sand Key, Fla., was broken October 5, 1914, and repaired October 16, at a cost of \$172.50. The damage was done, apparently, by the tank steamer *Sioux*, which, during a strong wind squall, dragged her anchors and fouled and broke the cable.

**ALPENA-THUNDER BAY AND MIDDLE ISLAND (MICH.) SECTION.**—During the year past the total time of interruptions to the telephone line was 4 days and 19 hours on the Middle Island line, and 1 day and 4 hours on the Thunder Bay Island line. The interruptions were almost entirely due to damage by lightning in the city telephone system with which our lines are connected. While the condition of these lines belonging to the Weather Bureau is fair, it has been 21 years since they were constructed and the question of gradual or complete reconstruction will of necessity arise in the near future. Vesselmen use the lines constantly and the revenues thus derived are turned into the Treasury as miscellaneous receipts.

The Beaver Island section from Charlevoix to St. James, Mich., was uninterrupted during the year and was maintained without expense.

Glen Haven-South and North Manitou Island section has worked uninterruptedly throughout the year without expense.

**POINT REYES-SAN FRANCISCO SECTION.**—This line is in a fairly satisfactory condition, and if the station at Point Reyes is to be maintained action will be taken to put the whole line in good repair.

**PORT CRESCENT-TATOOSH ISLAND SECTION.**—Communication between Port Crescent and Tatoosh Island was interrupted for a total of 22 days during the past year. This was about 4 days more interruption than last year. The interruptions were the result of logging operations and wagon-road and railroad building, rather than the result of stormy weather. During the same period communication between Port Crescent and Seattle via the Western Union wires was interrupted for a total of 45 days and 9 hours, and by the Postal Telegraph the total interruption was 56 days and 23 hours. It will be noted that, notwithstanding the rough country through which the Government maintains and operates this line, it is kept in more efficient condition than the commercial lines. The line has been of great benefit to shipping, fishing, and other commercial interests during the year, and the telegraph business must necessarily increase as the country is settled and new industries open.

#### FORECASTS AND WARNINGS.

For a number of years the issue of forecasts and warnings has been most satisfactorily accomplished by subdividing the territory of the United States into several large districts and placing each district in charge of a specially trained and competent forecaster. District

headquarters are now located at Washington, Chicago, New Orleans, Denver, Portland, and San Francisco. The Washington office until recently made all the forecasts on the evening observations, except for the Pacific coast districts. Provision, however, was made near the close of the year so that the night as well as the morning forecasts should be issued from Chicago and Denver for their respective districts. Two advantages result from these changes. The Washington forecaster has a smaller territory at nighttime for which predictions are required, and more time and study can therefore be given to the region covered, while, on the other hand, the preparation of two daily forecasts keeps the district forecaster in closer touch with the current changes in weather conditions than is likely to be the case when he is responsible for only one forecast. Advantages in local distribution are also realized. The Washington forecasters prepare all storm warnings for the Great Lakes and the Atlantic and Gulf coasts, and exercise a general supervision over all the forecasting activities of the Bureau.

Periodical inspections of the principal stations of the service are made by the Washington and other district forecasters.

During the year the Weather Bureau issued daily its usual 36 and 48 hour forecasts of weather, temperature, and winds, and prepared and issued special warnings of frosts, cold waves, storms, and heavy snows.

**WEEKLY WEATHER FORECASTS.**—The weekly forecast issued prior to August, 1914, was then suspended because of the interruption of reports from foreign meteorological services brought about by the European war. The issue of a weekly forecast was resumed, however, in a modified form in April, 1915. This forecast is prepared and issued Tuesday forenoon for the week beginning on Wednesdays and is immediately sent to the press associations, and selected portions are telegraphed to certain distributing centers, where they are printed on cards and distributed by mail to such rural newspapers and individuals as can utilize the information or aid in its dissemination.

The most severe and disastrous storm of the year was that of December 7-9, 1914. This disturbance passed up the Atlantic coast, causing high winds and tides along the Atlantic seaboard and considerable property damage along the Delaware and New Jersey coasts. Warnings were issued well in advance.

The Atlantic coast storm of April 2-5, 1915, including Easter Sunday, was quite a severe one in many respects. From a point off the southwest Florida coast on the morning of the 2d it passed northward up the Atlantic coast with increased intensity to a position over the Grand Banks by the morning of the 5th. Storm warnings were ordered for the entire Atlantic coast, and gales occurred, with some damage to shipping. Heavy falls of snow occurred over portions of eastern Pennsylvania, southern New York, New Jersey, Delaware, and New England. A fall of 19 inches was reported from Philadelphia, Pa.

One of the most pronounced cold waves of the winter occurred during the latter part of January, 1915. On the evening of the 26th a very cold high-pressure area was central over the Canadian Northwest. Low temperatures had prevailed for several days over the



Northwestern States and no further warning was necessary, but warnings were ordered for eastern Colorado, western and southern Wyoming, eastern and southern Iowa, and the interior of northern Illinois, and during the 27th were extended generally over the Lake Region, the Central Valleys, New England, and the Middle Atlantic States. This cold wave proved to be the most pronounced of the winter of 1914-15, temperatures as low as zero occurring almost to the Ohio River.

During the month of November, 1914, a succession of storms of marked character crossed the Great Lakes, causing winds of storm force. The rapidity with which one storm followed another was most marked, and necessitated many warning advices.

The heavy and continued rains of May and June, 1915, in Kansas, Nebraska, and adjoining sections, while not producing marked floods in the rivers, nevertheless wrought immense damage to standing crops, not only from overflow and total destruction of the crop in bottom lands along the rivers and small streams, but also by reason of the saturated condition of the soil, it being impracticable to gather the crop until the ground dried out.

An estimate of the damage to crops and farm lands in Kansas places the amount at \$6,000,000, with an additional \$1,500,000 along the Missouri east of Kansas City.

#### WEATHER FORECASTS DISTRIBUTED BY WIRELESS.

Amateur wireless operators at Illiopolis, in Illinois, were permitted to aid in the distribution of weather forecasts by a scheme put in operation in June, 1915, as follows:

The sending station receives the forecasts usually by mail or by telephone, and broadcasts them between 12.45 and 1 p. m., in a message sent out at a slow rate—about 10 or 12 words a minute—to accommodate inexperienced operators. The receiving operator copies the message on an approved card and posts it for the benefit of his neighbors. Three places in Illinois—Illiopolis, Rock Island, and Springfield—send the forecasts in this manner, and 16 places in the State receive them. The total number of cards posted daily, except Sunday, is 38.

The distribution of forecasts by wireless was also begun in January, 1914, at University, N. Dak., from which source nine places in the State are supplied.

#### STORM-WARNING SIGNALS.

At the earnest solicitation of marine interests, especially those on the Great Lakes, a decided improvement in the former system of night storm-warning displays has been worked out so as to convey more definite information by means of the lantern displays. By this arrangement the direction of the expected wind can be shown to the nearest four quadrants instead of to only two directions, as heretofore.

The new night storm-warning signal consists of three lights in a vertical line. Special experiments conducted by the Instrument Division showed that in order to be seen separately by the naked eye as two bright objects the lights must be approximately 4 feet apart for each mile the observer is distant. To secure great brilliancy a standard electric lamp of the gas-filled tungsten type is being tried out, and necessary modifications in the standard lantern are being made. The

new system of night storm-warning displays will be put into operation first on the Great Lakes, and at the earliest practicable date.

Mention may be made of one or more of the new problems the forecasters have under investigation and which will probably be completed during the coming year:

(1) A discussion of the probability of precipitation from the different recognized types of low-pressure areas or storms over the various sections of the United States (H. C. Frankenfield and F. W. Krichelt). This discussion will observe the classification and arrangement adopted in the study of types of storms and storm movements in the United States (Edward H. Bowie and R. Hanson Weightman), issued as Supplement No. 1, Monthly Weather Review, 1914.

(2) A study of types of high-pressure areas of the United States and their movements (Edward H. Bowie and R. Hanson Weightman).

(3) The seriously disturbing influences of heavy local thunderstorms on electrical transmission lines, and the important consequence of these effects to a great part of the population of large cities, necessitate and justify a more intimate and careful study of these local atmospheric phenomena than has been given to them heretofore. It is hoped the Weather Bureau will be able to give increased attention to this interesting problem also.

#### RIVER AND FLOOD SERVICE.

General and destructive floods were absent during the year, although local torrential rains in southwest-central Texas in the latter part of April, 1915, caused severe floods in the smaller streams that were responsible for a loss of 40 lives and a very large money loss in crops and farms damaged that has been estimated at a little more than \$3,000,000.

**INSTRUMENTAL EQUIPMENT.**—The experience of many years with respect to river gauges may be stated thus:

(1) Vertical staff gauges are to be preferred when local conditions admit of their use.

(2) Sloping gauges of concrete construction, while expensive, are necessary in large streams like the Ohio and Mississippi, in the absence of bridges or docks.

(3) Chain and weight gauges, where they can be used, afford a simple and fairly accurate means of determining the level of the water. They should be frequently checked in order to secure accurate results.

During the year a supply of a form of short-gauge box in conjunction with an enameled scale has been secured. These are superior to an older form suitable under similar conditions, and the new form will replace the old as the latter becomes unserviceable.

**INSPECTION OF STATIONS.**—A large number of special river stations have been inspected during the year, but it does not seem possible, except in rare cases, to have the zeros of the gauges and other measurements accurately checked by precise leveling.

A first step in the accurate checking of the zeros of river gauges has been taken in the appointment of an engineer to the service, with headquarters at St. Louis, Mo. It is estimated that at least two other engineers should be brought into the service, so that eventually one each would be available for the Pacific Coast, the Mississippi Valley, and the Atlantic Coast States.



**COOPERATION WITH FOREST SERVICE.**—The experiment station jointly maintained by the Forest Service and the Weather Bureau at Wagon Wheel Gap, Colo., has been maintained throughout the year. The main effort has been centered in securing climatological and hydrological measurements in the lower watersheds.

The Weather Bureau keeps a detail of its skilled observing force at the Wagon Wheel Gap Station, but there are other projects in Western States where it simply furnishes the instrumental equipment.

#### EMPIRICAL RULES FOR FLOOD FORECASTING.

The construction of a set of empirical rules for the forecasting of floods on the principal rivers of the United States was begun some years ago and has been carried on continuously ever since. During the current year rules for the rivers of South Carolina have been completed and sent to the flood-forecasting center of that State for trial and such modification as may be found necessary by practical experience. The object in reducing the flood-forecasting rules to writing is twofold: First, to preserve the experience gained by the different officials who have been connected with the work, and, second, to minimize the labor that an official on being assigned to any district that is new to him will have to perform in order to become fully acquainted with the regimen of the rivers in the district.

Forecasting rules have thus far been prepared for the majority of the principal rivers of the interior valleys.

#### METEOROLOGICAL RECORDS AND PUBLICATIONS.

The Annual Report of the Chief of the Weather Bureau, containing climatological data for the calendar year 1913, was printed and distributed as in former years. The customary serial and statistical reports of the Bureau were also issued without interruption. The constantly growing demand for these seemingly dry and uninteresting documents indicates the increasing extent to which the public is learning to make use of the valuable information they contain.

The biennial report on daily river stages, containing the daily gauge readings for 526 stations, has been put through the press and is now available for distribution.

The National Weather and Crop Bulletin was prepared along the lines adopted at the beginning of July, 1914, except that during the present season the date of issue was changed from noon Tuesday to noon Wednesday of each week and provision made for the printing of weekly weather forecasts and a more extensive discussion of the effects of the week's weather upon the principal growing crops, both of which changes appear to have met popular approval. The change in date of issue from Tuesday to Wednesday was a most welcome one to the station officials, as it offered much relief from the usual congestion of work on Mondays and afforded a better mail service in collecting data from their various correspondents.

Telegrams containing summaries of the more important features of the weather and crop conditions over the great corn, wheat, and cotton districts have been furnished the principal Weather Bureau centers in those districts promptly each week for distribution to the public. Likewise the section directors have been authorized to give to the press and others interested, at 12 noon on the date of the issue

of the National Weather and Crop Bulletin, copies of the weekly summaries telegraphed to the central office for use in the bulletin, expanded as necessary. This service has recently been extended so that these summaries are furnished to each Weather Bureau station in the respective States, to be given to the public at the appointed hour.

Snow and ice bulletins were issued weekly during the past winter, as usual, and the snow bulletins for the western Mountain States, issued monthly, were, as a rule, considerably enlarged over those issued for previous years, and contained much additional information regarding the amount and condition of the snow stored in the higher mountains.

The monthly and annual publications of the climatological service of the several States have been published regularly, furnishing prompt means for distributing the information they contain to the interested public. The collection of these summaries for the respective States into single volumes each month, containing a report for each State, has been accomplished as promptly as possible. The number of complete sets now assembled and distributed has increased to nearly 450, and requests to be listed for this publication are still being received.

The daily bulletins for the corn and wheat, cotton, sugar and rice, cattle, and other interests have all been issued regularly with a continued increase in the circulation.

During the year the abridged set of climatic charts was brought down to date, where necessary, and reprinted, and several important additions were made to the set, notably four charts of average relative humidity at 8 a. m. and 8 p. m., January and July, and two of the average temperature for the same months. On account of the numerous demands for Bulletin V, Frost Data of the United States, the supply became exhausted and a reprint necessary, which was accomplished during the year.

Calls for climatological and other data continued as in previous years, the total number of such requests handled at Washington being about 5,000.

The numerous calls for the data contained in the summaries of climatological data by sections, Bulletin W, exhausted some of the separate parts, and new editions of several of the individual sections have become necessary. Some of these have been printed already and others are now ready to go to the printer.

During the year a large amount of work has been accomplished in compiling climatological data for a proposed atlas of agricultural meteorology in cooperation with other bureaus of the department, the largest individual piece of work being the reduction of the precipitation data for the 20-year period 1895 to 1914, inclusive, to a uniform basis. This has necessitated the compilation of the reports from about 3,000 different points throughout the United States, the computation of means, and the establishment of the ratios of the short records to the full 20-year period. Much assistance has been given in this work by the station officials, who have cheerfully responded to every call made upon them. The work is now well advanced, and the material gathered will be of much value to the Bureau in addition to serving the purpose for which originally gathered.



The Monthly Weather Review has continued to appear monthly, presenting numerous important scientific papers bearing on all branches of meteorology and climatology. By authority of Congress the Weather Bureau has been authorized to include seismological investigations in its work, and on December 1, 1914, a section including seismological reports was added to the Review and regularly published thereafter. The Review contains, in addition, statistical tables presenting the results of meteorological observations at all the regular stations of the Bureau.

A committee on scientific papers was appointed during the year to examine and pass upon the merits of scientific papers submitted by Weather Bureau employees, not only to determine their appropriateness for publication, but to give proper credit to their authors for application and abilities thus represented. Twenty papers have been examined and four have been published in the Monthly Weather Review.

A monograph by Messrs. Bowie and Weightman, presenting an extensive study of the movements of storms across the United States, was published at the end of November as Supplement No. 1 to the Monthly Weather Review. A unique collection of meteorological and phenological observations by one man at the same place for over 30 years was offered to the Bureau by Cooperative Observer Thomas Mikesell, of Wauseon, Ohio. This collection compiled and edited by J. Warren Smith will be published as Supplement No. 2.

The assistant editor translated Dr. Besson's pamphlet, "Different Forms of Halos and Their Observation," for publication in the Review. This very useful guide was also issued separately in octavo pamphlet form and distributed to the Weather Bureau observers as an aid to them in improving our records of halo phenomena in the United States. It is a satisfaction to be able to report that some improvement in our observations is already noticeable.

Beginning in May, 1915, the Monthly Weather Review was put on a regular monthly schedule by the Government Printing Office, thereby insuring its publication on the last day of each month, instead of on widely different dates as in the past.

#### PRINTING DIVISION.

A printing office is maintained at the central office of the Weather Bureau in Washington, for the purpose of promptly printing and distributing weather maps, bulletins, charts, etc., relating to current meteorological conditions. It is indispensable that this printing office be maintained under the supervision of the Chief of the Weather Bureau, for the reason that the maps, bulletins, charts, etc., must be printed and issued as promptly as possible after the information conveyed therein becomes available, as any material delay in their issue and dissemination would render them of little value.

The printing office in Washington also supervises similar but much smaller printing equipments maintained at the principal stations of the Bureau throughout the country and which likewise print and distribute local weather maps, bulletins, and important meteorological information. Incidentally the printing office supervises other work of a printing nature that does not require to be immediately issued

and that, therefore, can be and is printed at the Government Printing Office.

Since the rush work of printing weather maps, bulletins, and the like does not occupy the force and facilities of the printing division for the entire eight hours of each working day, the remaining time is filled in with items of miscellaneous printing for either the central office or the field stations. In this way the plant and equipment are used in the most economical manner possible. The following summary will indicate approximately the work done during the past year:

#### OUTPUT OF PRINTING PLANT.

##### LITHOGRAPHIC.

	Copies.
*Charts for Monthly Weather Review.....	198, 450
*Charts for Review Supplement No. 1.....	105, 200
*Charts for Climatological Data.....	3, 222, 240
*Climatic Charts in sets of 11 each.....	5, 500
*Charts for Bulletin V.....	10, 500
*Washington weather maps.....	467, 950
*National Weather and Crop Bulletins.....	132, 000
*Snow and Ice Bulletins.....	26, 000

##### PRINTING.

Station map bases.....	3, 942, 000
*Daily forecast cards.....	472, 750
*Monthly meteorological summaries.....	2, 640
Franking forecast cards for stations.....	21, 675, 000
Rural free delivery slips.....	1, 368, 000
Covers for publications.....	18, 520
Blank forms.....	1, 952, 830
*Climatological data (Maryland, Delaware, and Virginia).....	11, 100
Letterheads.....	301, 850
Addressing envelopes and telegram blanks.....	50, 600
Memorandum slips.....	413, 100
Skeleton letters.....	19, 970
Leaflets.....	45, 200
Cards.....	193, 590
Instructions.....	19, 350
Circulars.....	20, 145
Miscellaneous.....	80, 055

##### PASTING, STITCHING, AND BINDING.

	Sets.
*Maps, forms, memorandum slips, and climatological data.....	9, 400

##### PERIODICAL PUBLICATIONS.

The daily, weekly, or monthly issue of our periodical publications at the end of the fiscal year was as follows:

	Copies.
Monthly Weather Review (printed at Government Printing Office).....	1, 375
Monthly climatological data (printed at 46 section centers).....	444
*Washington weather map, first edition (daily except Sundays and holidays).....	1, 015
*Washington weather map, second edition (daily except Sundays and holidays).....	415
*Washington weather map, Sundays and holidays.....	530
*National Weather and Crop Bulletin (weekly April to September, monthly October to March).....	3, 325
*Snow and Ice Bulletin (weekly during winter).....	1, 320
*Forecast card (daily except Sundays and holidays).....	1, 550
*Weekly forecast card.....	200
*Monthly Meteorological Summary for Washington.....	225

The foreign distribution of all publications was suspended by departmental order dated August 10, 1914, on account of the European War. This service, however, was resumed in part during October, 1914, and full service by mail, or through the International Exchange Service where possible, was authorized on February 1, 1915. Back numbers of publications for countries that can not yet be reached by the exchange are being held for future shipment.

The distribution of the various periodical publications to foreign addresses is as follows:

	Addresses.
Daily weather map.....	87
Monthly Weather Review.....	370
Monthly Climatological Data.....	75
National Weather and Crop Bulletin.....	27
Snow and Ice Bulletin.....	10

Subscriptions filled by this division and covered by remittances made to the Superintendent of Documents were as follows at the close of the year:

	Subscribers.
National Weather and Crop Bulletin.....	360
Washington weather map.....	51
Snow and Ice Bulletin.....	33
Monthly Climatological Data.....	5

The aggregate receipts from the above sales exceed \$400 annually.

Subscriptions for the Monthly Weather Review are filled by the Superintendent of Documents, who is supplied with 75 copies per month for that purpose.

#### PRINTING PRESSES AT STATIONS.

Owing to the quantity and character of the printing done at our New York and New Orleans offices, a small cylinder press was provided for each of these stations, which, together with the platen presses already in use, has greatly expedited the issue of their publications.

Small platen presses for printing commercial weather maps, with complete outfits of printing materials, were shipped during the year to the stations at Spokane, Wash.; Lansing, Mich.; Springfield, Mo.; Birmingham, Ala.; and Sioux City, Iowa.

The process of standardizing the type and logotypes at all stations was continued during the year as occasion demanded, i. e., whenever it could be done without waste of still serviceable old-style type.

At the present writing there are 46 stations equipped with presses of sufficient size for printing maps DD, 32 stations with small presses for printing maps CM, and 9 stations with 5 by 8 inch Pearl presses for printing forecast cards and other small matter.

#### LIBRARY.

During the year 935 books and pamphlets were added to the library, as compared with 1,167 additions last year, bringing the strength of the collection up to about 35,000. The apparent decrease in the number of volumes added during the year is due to the fact that many unbound annual publications formerly accessioned separately and included in the count of volumes added to the library are now treated as periodicals and not counted as separate accessions.



Special work carried out by the library during the year includes the preparation, at the request of Mr. Melvil Dewey, of a scheme of classification for meteorology to be used in connection with his decimal classification; also the compilation of a brief bibliography on weather forecasting for use in the forthcoming forecasting manual.

The number of promotion-examination papers rated during the fiscal year was 80, of which 64, or 80 per cent, attained passing grades.

### SEISMOLOGY.

It is generally recognized that the systematic collection and arrangement for convenient reference of earthquake data serve several useful purposes. As the data are accumulated and earthquake regions more minutely mapped the engineer is correspondingly able to distinguish with greater certainty between safe and dangerous localities for bridges, dams, aqueducts, or any other important structures. A knowledge of the magnitude, rapidity, and other peculiarities of earth movements is of especial value in the designing of structures of whatever kind to be erected in earthquake regions. Finally, detailed data concerning earthquake motions serve a very valuable purpose in the science of geophysics.

To further these important studies as much as possible, the Weather Bureau began on December 1, 1914, to collect noninstrumental reports of earthquakes from all its regular stations, nearly 200 in number, and also from nearly all its 4,500 cooperative observers. These data are published month by month in the Weather Review.

In addition, the Bureau operates two seismographs—a Marvin vertical pendulum seismograph, giving both horizontal components, at Washington, D. C., and a two-pendulum Bosch-Omori instrument at Northfield, Vt. The Washington records were resumed in October, 1914, and those of Northfield, Vt., began in December, 1914.

Beginning with January 1, 1915, the Bureau has also collected and published as far as possible instrumental records of earthquakes obtained at—

Sitka, Alaska, United States Coast and Geodetic Survey.  
 Tucson, Ariz., United States Coast and Geodetic Survey.  
 Honolulu, Hawaii, United States Coast and Geodetic Survey.  
 Cheltenham, Md., United States Coast and Geodetic Survey.  
 Porto Rico, United States Coast and Geodetic Survey.  
 Point Loma, Cal., Raja Yoga Academy.  
 Denver, Colo., Sacred Heart College.  
 Georgetown, D. C., Georgetown University.  
 Lawrence, Kans., University of Kansas.  
 Cambridge, Mass., Harvard University.  
 St. Louis, Mo., St. Louis University.  
 Buffalo, N. Y., Canisius College.  
 Fordham, N. Y., Fordham University.  
 Balboa Heights, Panama Canal Zone.  
 Ottawa, Canada, Dominion Observatory.  
 Toronto, Canada, Dominion Meteorological Service.  
 Victoria, British Columbia, Dominion Meteorological Service.

### AEROLOGICAL INVESTIGATIONS.

Observations of the diurnal convective system have heretofore been made by means of kites and have necessarily been limited to heights of 3 to 3.5 kilometers. It seemed desirable to have a 24-hour

series of observations to greater altitudes. This was accomplished by means of sounding balloons on July 17 and 18, 1914, at Fort Omaha, Nebr. The observations are not yet completely reduced or published.

Pyrheliometric observations at great altitudes were made in cooperation with the Smithsonian Institution during July, 1914, at Fort Omaha. Three automatically recording pyrhemeters, devised and calibrated by the Astrophysical Observatory of the Smithsonian Institution, were carried up by means of free air balloons. Balloon meteorographs were sent up within an hour or two of the time of the pyrhemeters' ascent. An excellent pyrhemetric record was obtained at a height of 25 kilometers. The complete data are not yet published, but a preliminary statement may be found in a recent report on Field Work of the Smithsonian Institution.

Kite flying from the deck of the United States Coast Guard cutter *Seneca* was undertaken during her May and June cruises into the ice fields of the North Atlantic; 12 observations by means of the kites were made during the May cruise and 16 during the June cruise. In addition to these observations, recording meteorological instruments were exposed on the deck of the *Seneca*, and sea-water temperatures were obtained. These observations will be reduced and published in the Monthly Weather Review.

In the transfer of the aerological work to the Middle West and to the central office at Washington, D. C., considerable progress has been made. It is expected that observations will begin during the fall of 1915.

METEORS.—Meteors often become luminous in the very highest regions of the earth's atmosphere of which we have any knowledge, and the careful and systematic study of meteoric appearances seems to be at the present time the only means we have of gaining information of this region of the atmosphere, which is almost beyond the reach of any other means of investigation. It is hoped that with the development of the aerological work, this line of study may also receive its appropriate attention.

### SOLAR RADIATION INVESTIGATIONS.

The standardization of Callendar pyrhemeters effected at Mount Weather in 1913-14 has made possible the reduction to heat units of records obtained at Washington by means of one of these instruments between July, 1909, and April, 1912. These data have been utilized to determine for Washington the diurnal and the annual variations in the hourly and daily amounts of solar and sky radiation. The results are published in the Monthly Weather Review for March, 1915, and the daily totals and departures from the normal have since been published monthly in the Review.

At the end of September, 1914, observations of the intensity of solar and sky radiation were discontinued at Mount Weather, Va. Before the end of the following month most of the radiation apparatus had been transferred to Washington and installed in the College of History building, American University, which affords excellent exposures for both the Callendar and the Marvin pyrhemeters.

The pyrheliometric measurements now obtained at the American University are considered a continuation of similar measurements made at the central office of the Weather Bureau previous to May, 1912. At the university the elevation of the pyrheliometers above sea level is about 100 meters greater and the pollution of the atmosphere due to city conditions is considerably less than at the Weather Bureau. It may be partly on this account that radiation intensities in excess of any heretofore observed at Washington have been measured at the university during the past year. On December 26, 1914, with the sun at zenith distance  $62.5^\circ$ , an intensity of 1.48 calories per minute per square centimeter of normal surface was measured, while on February 28, 1915, with the sun at zenith distance  $57.5^\circ$ , the intensity was 1.50 calories.

During March and April, 1915, the stations at Madison, Wis., Lincoln, Nebr., and Santa Fe, N. Mex., were visited by the official in charge of solar-radiation investigations, and the Marvin pyrheliometers in use were recompared with a Smithsonian silver disk pyrheliometer. The radiation measurements obtained at these stations have since been tabulated in form for publication. Those for Santa Fe, which is 7,000 feet above sea level and in an arid region, show radiation intensities a few per cent in excess of the measurements obtained at other stations. On November 20, 1914, a maximum of 1.64 calories per minute per square centimeter of normal surface was measured with the sun at zenith distance  $55^\circ$ . On the same day with the sun at zenith distance  $60^\circ$  the intensity was 1.60 calories. These exceed any previous measurements obtained at Santa Fe. Likewise, at Madison, Wis., the monthly maxima from November, 1914, to March, 1915, exceed the maxima for corresponding months since the fall and winter of 1911-12, and the midday intensity of 1.50 calories obtained at Mount Weather on September 28, 1914, was the highest ever measured at that station. We are therefore led to the conclusion that unusually clear skies were experienced in the United States during the fall and winter of 1914-15, although in some districts the cloudiness was above normal.

The official in charge of solar radiation investigations and an assistant spent most of the month of May, 1915, among the mountains of southwestern North Carolina, where special temperature investigations in the interest of horticulture are in progress. Measurements were made of the rate at which heat is radiated to the atmosphere from a blackened surface when located in a valley at the foot of a mountain slope, when on a mountain slope, and also when on a mountain peak. The results of these observations, when fully discussed, will be published in the Monthly Weather Review or elsewhere.

At the end of June, 1915, the Marvin pyrheliometer in use at Lincoln, Nebr., was moved from the Weather Bureau office, in the business section of the city, to the experiment station building on the State University farm, just outside the city limits. A Callendar pyrheliometer was also installed on the roof of the same building, at an elevation of 56 feet above ground and 1,340 feet above sea level. The radiation records will be utilized by the Nebraska experiment station in its investigations, as well as by the Weather Bureau in its climatological studies.



The Weather Bureau is now obtaining continuous records of the amount of solar and sky radiation received on a horizontal surface at Washington, D. C., Madison, Wis., and Lincoln, Nebr. At each of these stations, and also at Santa Fe, N. Mex., the intensity of direct solar radiation on a surface normal to the incident solar rays is measured at frequent intervals on clear days.

## REPORT OF THE CHIEF OF THE BUREAU OF ANIMAL INDUSTRY.

UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF ANIMAL INDUSTRY,  
*Washington, D. C., September 28, 1915.*

SIR: I have the honor to transmit herewith a report of the operations of the Bureau of Animal Industry for the fiscal year ended June 30, 1915.

Respectfully,

A. D. MELVIN,  
*Chief of Bureau.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### GENERAL STATEMENT.

The most serious event of the year in the bureau's work was an outbreak of foot-and-mouth disease, which was first diagnosed in October, 1914. This has been by far the most extensive of the occasional visitations to the United States of this highly contagious animal plague. The disease occurred in 21 States and the District of Columbia. After months of energetic effort, in cooperation with the authorities of the various affected States, the outbreak was brought under control, and by the close of the fiscal year eradication appeared to be almost accomplished, though infection has since developed in some localities.

The meat inspection showed an increase over the two preceding years, more than 58,000,000 animals having been slaughtered and over seven and one-half billion pounds of meat and meat food products having been prepared under this inspection. A new method of destroying trichinæ in pork has been discovered by the bureau and has simplified and rendered more effective the precautions against danger in pork prepared customarily to be eaten without cooking. It has been found that refrigeration at a temperature not higher than 5° F. for a period of 20 days is effective in destroying the trichina parasites. This method as an alternative to the previously known method of thoroughly cooking renders unnecessary the expensive and unsatisfactory microscopic inspection which had formerly been used and abandoned in this country and which is still used in some countries.

The boys' and girls' pig clubs and poultry clubs have been extended and continue to be a valuable means of increasing and improving stock and poultry raising. The pig clubs have 9,000 members and the poultry clubs nearly 4,000. By means of these clubs many children are enabled to earn money to get an education.

Work for the development and improvement of the dairy industry has been continued with good effect. Improvement in the quality of market milk as a result of the efforts of the department and various other agencies is very apparent. By means of cow-testing associations and encouraging dairy farmers to keep records of the feed and production of their herds, the milk yield of many herds is being increased and the cost reduced. Assistance has been given in establishing creameries in sections previously without them and in which there is a good prospect of success.

In the work of eradicating the southern cattle ticks good progress has continued and an additional area of 37,255 square miles has been freed from ticks and released from quarantine, making a total of 253,163 square miles released since the work was begun in 1906. As this work proceeds and its benefits become apparent, it is being more heartily supported and pushed by the people. In the territory already freed of ticks work is being done for the building up of beef cattle and dairy industries.

The eradication of scabies of sheep and cattle in the West has been brought still nearer to completion.

The experimental work for the control of hog cholera, which has been carried on for the past two years, has demonstrated that while eradication in limited areas may be accomplished by means of inoculation with protective serum and proper quarantine measures, any general effort to eradicate this disease from the United States would be a tremendous and expensive undertaking and would require more effective State laws and organizations. This subject is discussed more at length in another part of this report.

#### FOOT-AND-MOUTH DISEASE.

In the latter part of August, 1914, the attention of the State veterinarian of Michigan was called by local veterinarians to a disease somewhat resembling foot-and-mouth disease which had affected two or three herds of cattle in Berrien County. After visiting the locality he consulted an assistant inspector on the meat-inspection force of the Bureau of Animal Industry at Detroit (in the absence of the inspector in charge), and together, on September 3, they made an examination of the cattle, but failed to recognize the affection as foot-and-mouth disease because the cases were old (having come under the observation of local veterinarians about 10 days before), because at the time there was a mixed infection which rendered diagnosis difficult, and because of the mild type of the disease at that time, the absence of lesions characteristic of that disease, and the presence of lesions due to secondary invasion of other infections. In other words, instead of the vesicles or watery blisters typical of foot-and-mouth disease, there were present scabs and pus from necrotic ulcers and the characteristic odor of necrotic stomatitis. The findings reported by the assistant inspector to the bureau by telegraph and also by letter were to the effect that the affection was not foot-and-mouth disease, but that the lesions were characteristic of necrotic stomatitis. A few scrapings forwarded to the pathological laboratory at Washington apparently were characteristic of a form of stomatitis, but arrived in such a condition as to render it impossible to make a diagnosis of foot-and-mouth disease. On account of the



unequivocal diagnosis of necrotic stomatitis already made, and the well-known presence of that disease in the United States as reported continuously by different branches of the bureau service, and because there had been nothing to indicate the presence of foot-and-mouth disease in the United States since 1909, there was no occasion for the pathological division to question the conclusion of the State veterinarian and the assistant inspector that it was not foot-and-mouth disease, especially as they had both had experience with this disease during the outbreak of 1908-9.

The possibilities of diagnosing a disease from a bit of tissue are at best restricted, especially if such tissue does not bear a characteristic relation to the disease with which it is associated. Mixed infection frequently leads to erroneous conclusions, and it has been justly stated that the result of laboratory examination should be considered only as one of the factors in arriving at any correct diagnosis. Without a suspicion of the virus of foot-and-mouth disease being in this country, and with absolute knowledge that both mycotic and necrotic stomatitis had been present during the summer as far east as South Carolina, as far west as Kansas, and as far south as Tampico, Mexico, where an official from Washington had been investigating the character of the disease for six weeks, it is not surprising that an examination of such atypical specimens of foot-and-mouth disease as pus and scabs admittedly are should reveal various molds and fungi and even the necrosis bacillus, but fail to disclose the true character of the disease. The virus of foot-and-mouth disease being ultramicroscopic and filterable in character, ordinary laboratory procedure would not determine its presence, and the inoculation of the usual laboratory animals is likewise insufficient.

On September 24 the pathologist of the Michigan live-stock sanitary commission visited an infected farm near Niles at the request of the owner, and made an examination of the cattle and collected specimens, but without arriving at a diagnosis of foot-and-mouth disease. The State veterinarian and this pathologist on September 26 visited the same farm as well as others. With regard to this visit the pathologist is quoted in the annual report of the bacteriologist of the State board of agriculture as follows:

I expressed the belief that the disease was foot-and-mouth disease and suggested that he [the State veterinarian] telegraph Washington that we were quite positive of foot-and-mouth disease existing in a number of herds around Niles, Mich., and asking for an investigation by an expert while waiting for the results of a laboratory investigation. He agreed with me that we had sufficient evidence that foot-and-mouth disease existed in these herds, but suggested that the matter be taken up with the local office in Detroit instead of directly with the office at Washington.

The specimens collected by the pathologist were taken to Lansing, and on September 28 he inoculated a calf with this material. By October 1 the calf showed fever and drooling, followed by erosions in the mouth, but the case was not diagnosed as foot-and-mouth disease, because of the absence of foot lesions.

Neither these visits nor the results of this inoculation were known to the bureau at Washington until October 10, when a letter was received from the inspector in charge at Detroit as hereinafter stated.

On October 12 the pathologist connected with the office of the State veterinarian of Indiana received specimens from infected animals and made cultures which, upon microscopic examination, disclosed

the necrosis bacillus, which was considered to be sufficient to explain the lesions as being those of necrotic stomatitis, although this organism has since been shown to have been a secondary invader.

The State veterinarian and the president of the live-stock sanitary commission of Michigan on October 5 got the inspector in charge of the bureau office at Detroit to go to Berrien County with them for another examination. A letter from the inspector, which made no diagnosis, but described certain symptoms in detail pointing to the possibility of foot-and-mouth disease, was received in Washington on Saturday afternoon, October 10, and was the first information to reach the officials at Washington giving ground for suspicion that foot-and-mouth disease might be present. This inspector had never had any experience with foot-and-mouth disease, and for that reason made no diagnosis, although the symptoms mentioned in his letter were quite characteristic. For the latter reason an expert was sent from Washington to Michigan on the first train after the letter was received, while calves were inoculated at the Washington experiment station, and on October 15 a positive diagnosis of foot-and-mouth disease was made.

On October 12 the chief of the bureau sent the following telegram to the State veterinarian:

Advise that farms where animals now show symptoms foot-and-mouth disease be placed in temporary quarantine until time for experiments on other animals.

This request was not carried out until later in the week, although it is not known that any animals were removed from these farms in the meantime.

The long time required for the inoculated animals to show any evidence of disease, as well as the slight extent to which the disease had spread on the farms before its nature became known, showed that at first the infection was of an exceedingly mild form, although it grew in virulence as the outbreak progressed. In spite of the fact that no quarantine measures had been imposed, the disease remained confined to a restricted area for more than six weeks, which is very unusual with foot-and-mouth disease, but very commonly observed in various forms of stomatitis.

As soon as the disease was diagnosed as foot-and-mouth disease steps immediately were taken to assemble a force of inspectors, and active scouting by employees of the Bureau of Animal Industry was begun, which disclosed 39 infected herds in southern Michigan and 7 in northern Indiana. The Secretary of Agriculture then issued B. A. I. Order 220, effective October 19, placing under quarantine the counties of Berrien and Cass in Michigan and St. Joseph and Laporte in Indiana.

On October 28 there were indications which led to the suspicion of the existence of infection in the Union Stockyards at Chicago, and an order was prepared, effective October 31, quarantining these yards and permitting animals to be shipped from them only for immediate slaughter. The presence of the disease there was later confirmed. The disease was further disseminated from large eastern stockyards. As the work of eradication progressed, it was found that infected and exposed animals had been shipped from various points and the

disease had spread over a large range of territory, and by the last of November it was found necessary to quarantine 20 States and the District of Columbia.

The source of the outbreak, which started near Niles, Mich., has never been definitely determined, and actual proof will probably never be obtained, although the infection was undoubtedly introduced in some way from abroad.

Arrangements were rapidly made at the beginning of the outbreak with the various State officials for cooperation in the work of eradication and the adjustment of fiscal losses. These agreements have in nearly every instance proved mutually satisfactory, and the aid given by the States has been of a generous and valuable nature. The cost of reimbursement for animals slaughtered and the expenses of slaughter, burial, disinfection, etc., have been chiefly divided on a 50 per cent basis between the State and Federal Governments. Owing to the nature of the work and other conditions, the farm-to-farm inspection, stockyard and railway supervision, and much of the actual physical labor, as well as much of the work of direction, have devolved upon the Federal inspectors, although considerable assistance has been rendered by veterinarians and others employed by the States.

#### METHODS OF ERADICATION.

At the beginning of the outbreak all shipments from the Union Stockyards at Chicago and from other infected centers were, as far as possible, traced to their destinations by means of waybills, sales slips, etc. All such animals were placed under immediate quarantine, pending examination and surveillance.

The method of slaughter of all infected and exposed animals, used successfully in this country in previous outbreaks, and which has universally been found to be the only effective means of eradication, was adopted. Infected herds were appraised, slaughtered by shooting, and buried as rapidly as trenches could be dug for the reception of the carcasses. In a few instances carcasses were disposed of by tanking or by burning.

Animals were appraised at their actual meat or dairy value by representatives of the State and Federal Governments. The appraising was usually done in the presence of the owner or his representative, and every effort was made to insure honest treatment to all parties concerned. Contracts for the burial trenches were let to the owner of the infected herd, whenever possible, at an agreed price for the work. Before being covered with earth hides were slashed and the carcasses eviscerated, after which a liberal sprinkling of unslaked lime was applied.

As each focus of infection was located veterinary inspectors were sent out to examine all susceptible animals within a radius of from 3 to 5 miles, the distance being determined by the nature of the environment and other conditions.

Inspectors and other employees engaged in eradicating foot-and-mouth disease are required to wear rubber outer clothing, which may be easily washed with disinfectants, and to fumigate and disinfect themselves upon leaving premises containing animals, whether found infected or not. In this manner the possibility of their spreading the disease is prevented.



## LOSSES.

The following table gives statistics of the outbreak and of the work of eradication up to the close of the fiscal year:

*Statistics of foot-and-mouth disease and work of eradication, fiscal year 1915.*

State.	Countries in State, <sup>1</sup>	Countries infected.	Herd.	Owners.	Premises.	Cattle slaughtered.	Swine slaughtered.	Sheep slaughtered.	Goats slaughtered.	Total animals slaughtered.	Date of discovery of infection.	Disinfection completed in State.
Connecticut.....	8	3	33	33	32	733	143	0	0	876	Nov. 19	Apr. 11
Delaware.....	3	1	12	12	12	152	49	22	0	223	Nov. 6	Dec. 31
Dist. of Columbia.....			3	3	3	48	5	0	0	53	Nov. 16	Mar. 2
Illinois.....	102	52	768	754	709	24,838	33,434	1,248	22	59,042	Nov. 1	Apr. 23
Indiana.....	92	19	120	115	103	2,355	3,871	615	0	6,841	Oct. 15	Mar. 2
Iowa.....	99	9	48	48	43	1,547	2,334	32	0	3,913	Nov. 5	Mar. 22
Kansas.....	105	4	6	9	6	1,217	313	0	0	1,530	Feb. 5	May 6
Kentucky.....	119	11	84	79	73	2,951	918	216	1	4,086	Nov. 9	June 18
Maryland.....	24	10	56	56	49	964	1,621	197	0	2,782	Nov. 3	May 15
Massachusetts.....	14	9	98	96	94	2,107	5,705	77	11	7,900	Nov. 5	Apr. 22
Michigan.....	83	16	272	271	239	2,947	3,993	852	0	7,792	Oct. 15	Mar. 18
Montana.....	31	3	32	32	15	1,408	11	237	0	1,656	Nov. 7	Jan. 3
New Hampshire.....	10	1	3	3	3	78	26	0	0	104	Nov. 29	Jan. 28
New Jersey.....	21	8	50	49	49	1,314	815	9	8	2,146	Nov. 9	June 9
New York.....	62	20	170	173	163	5,410	489	150	38	6,087	Nov. 4	May 18
Ohio.....	88	39	222	221	204	4,019	4,994	3,136	1	12,150	Nov. 3	Apr. 2
Pennsylvania.....	67	34	904	878	795	14,989	12,055	369	17	27,430	Nov. 1	Apr. 29
Rhode Island.....	5	3	59	58	54	988	375	33	0	1,396	Nov. 7	Mar. 24
Virginia.....	100	3	8	8	6	378	470	0	0	848	Nov. 12	Mar. 20
Washington.....	39	1	1	1	1	102	0	0	0	102	Nov. 16	Nov. 21
West Virginia.....	55	3	22	22	14	193	189	114	0	406	Feb. 26	Apr. 12
Wisconsin.....	71	12	40	40	37	1,504	1,764	1,435	1	4,704	Nov. 4	Mar. 21
Total.....			3,021	2,961	2,707	69,742	73,574	8,742	99	152,157		

<sup>1</sup> The number of counties in each State is given in order to show by comparison with the number infected the approximate area involved.

The total appraised value of the animals slaughtered in the eradication of foot-and-mouth disease to June 30, 1915, amounts to \$5,243,138.55. Disposal of the carcasses cost a total of \$156,049.22, and property to the value of \$22,158.51 was destroyed in disinfection. One-half of these amounts have been paid by the department. These amounts do not include the sums paid for salaries of inspectors, traveling and hotel expenses, and other expenditures.

The National Dairy Show was held at Chicago October 22 to 31, although the bureau inspector in charge at that place had warned the manager of the show, prior to its opening, against the danger of holding it, in view of the outbreak of foot-and-mouth disease. At the close of the show the State veterinarian was requested by the chief of the bureau to hold the cattle for a few days so as to determine whether any infection had gotten into the herd. This was done purely as a precautionary measure, as there was no evidence of infection in the herd or in the stockyards at that time.

On November 1, 1914, one of the cows in the dairy-show herd was found to be suffering from foot-and-mouth disease, and the herd was immediately placed under close quarantine. This herd consisted of over 700 head of valuable pure-bred cattle, comprising in some instances the very cream of years of systematic breeding. Fortunately, the herd was confined in a tight brick building, where it was possible to maintain strict quarantine, flies were not in season, and the conditions made it practicable to try to save these valuable animals. Employees and other persons entering the building were

not permitted to leave until they had been thoroughly fumigated and disinfected. No outside animals, such as dogs, cats, poultry, or birds, could gain access to the building. After apparently complete recovery the herd was released from quarantine May 31, 1915. Before release a large number of animals were introduced into the herd and subjected to various severe tests to ascertain, if possible, whether any of the animals still harbored infection. The expense of maintaining quarantine, care, feed, disposal of manure, etc., was so heavy that it exceeded several times the average value of farm cattle. Such methods could not be applied in other cases because of the great expense and the impossibility of providing conditions of absolute quarantine on ordinary farms.

#### RECURRENCE OF OUTBREAK.

By June 18, 1915, all known infected and exposed animals had been slaughtered and the disinfection of premises completed, and it appeared that the disease was eradicated. On July 28, however, infection was again discovered in Steuben County, N. Y. No infection had previously been found in that county, and the infection had doubtless existed for some months in a small remote valley. Seven herds were slaughtered in this county. Again, on August 8, the discovery was made that infection existed in Illinois, and shortly afterwards a diseased herd was found in each of the States of Indiana and Minnesota.

At the time this report is submitted the disease has been eradicated in every State but Illinois, where it still continues to spread, although every effort is being put forth by the authorities of that State and by this department to stamp it out. So far 11 counties have been reinfected, and it has been necessary to slaughter some 400 herds, most of which were small.<sup>1</sup>

The cause of this recurrence of the disease was promptly and carefully investigated, and it was ascertained that it was due to infected hog-cholera serum. This serum was produced at an establishment where foot-and-mouth disease was not known to exist at any time, and had been carefully tested for foot-and-mouth disease virus with negative results before any of it was allowed to be sent out and used. It was only after further and repeated tests involving 62 animals that one of these animals in the last series developed foot-and-mouth disease, thereby demonstrating that the serum was infected.

#### THE ANIMAL HUSBANDRY DIVISION.

The Animal Husbandry Division, of which Mr. George M. Rommel is chief, carries on work relating to the breeding and feeding of farm animals and poultry.

#### BEEF AND PORK PRODUCTION INVESTIGATIONS.

The experimental work in beef production, which was transferred from Alabama to Mississippi in 1914, is being conducted in cooperation with the Mississippi experiment station. The work is in progress in the black-prairie soil belt and also in the brown-loam section of the State. The prairie lands have always been used to a certain extent

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<sup>1</sup> Data revised to Nov. 10, 1915.

for grazing cattle, but hundreds of farmers are now diversifying their crops and establishing herds of good cattle. The farmers of the brown-loam section have been forced to take up live-stock raising because of the ravages of the boll weevil and because no other form of farming has proved so generally satisfactory or profitable. About 200 steers and calves were used during the past winter in an experimental study of methods of fattening animals for the market. The use of supplementary feeds for summer feeding on pasture is being studied in both sections. A herd of breeding cows has been secured for making a study of the cost of raising beef calves in the brown-loam section. Breeding and feeding records are kept of each female in the herd.

In continuation of the experimental cattle-feeding work in cooperation with the North Carolina experiment station a test was made to determine the most economical method of wintering steers in North Carolina. It has been found that steers can be wintered very economically on mountain meadow land on which the grass and clovers have been permitted to grow up after the first cutting. Such meadows were made by cutting the brush off the steep mountain sides, burning the brush, and sowing the seed on the ashes and the partial sod of grass. Such lands could be utilized for grazing purposes only. Yearling steers, receiving no other feed except the grass, actually gained in weight during the winter and were wintered at a cost of about \$5 a head, while steers kept in the dry lot and given feed lost some in weight, and the cost of wintering was from \$8 to \$10 each. Three carloads of heavy steers were used in testing different methods of fattening cattle for the market.

Experimental work in beef production was taken up in cooperation with the West Virginia experiment station. An experiment was carried on to determine the most economical rations for wintering yearling steers in dry lots. At the end of the wintering period all of the steers were put on grass, and the effects of the winter feeding upon the gains made during the summer are being studied. The results indicate that it is cheaper to winter steers on a ration of cottonseed meal, corn silage, and oat straw than to use only dry roughage, such as hay and straw.

#### BEEF-CATTLE EXTENSION WORK.

The appropriation act for the fiscal year 1915 included an item for live-stock demonstration work in the areas freed of ticks. This work was taken up in North Carolina, South Carolina, Georgia, Tennessee, and Arkansas, in cooperation with the State agricultural colleges and the Office of Experiment Stations (now the States Relations Service) of the department.

The beef-cattle agents have formed 35 live-stock associations and addressed over 250 groups of farmers, numbering over 19,000 persons. Eight hundred and twenty-seven head of registered beef cattle for breeding purposes and several hundred hogs have been brought into the territory in which the work is conducted. Definite demonstrations with live stock have been carried on. These embrace cattle feeding, hog feeding, improvement of permanent pastures, silo building, castration, and dehorning.

In South Carolina 203 cattle were fed by small farmers under instruction of the department's agents, and were sold cooperatively at



the end of the feeding period. In Tennessee 425 cattle were similarly fed, 172 demonstrations were started with a continuous forage-crop system for hogs, and 1,440 men who fed cottonseed meal to their work stock according to directions reported very satisfactory results, with quite a saving in the cost of feeding. In Georgia 582 farms were visited and advice was given concerning the feeding and management of the stock and the building of suitable pens, sheds, feed lots, and silos. In North Carolina 267 farmers were advised in a similar manner. In four counties of South Carolina 660 registered hogs were brought in for breeding purposes.

The beef-cattle extension work in the Panhandle portion of Texas was continued. The ranchmen of that section are no longer producing feeder cattle exclusively, but are beginning to grow forage crops and to fatten the cattle for market. The beef-cattle agent, with the assistance of the county agents, has been of much assistance in establishing this new work and making it profitable. Eighty demonstrations in cattle feeding were conducted and the feeding of 7,000 cattle for market was supervised. In addition 200 other cattlemen and 25 hog feeders were visited and sample rations were made out for them to follow. One thousand hogs were fed under the agent's direction, plans and suggestions were furnished for the construction of 76 silos, and special directions were given for filling 150 silos.

#### PIG CLUBS.

The organization of boys' and girls' pig clubs was continued in Louisiana, Alabama, and Georgia, and was begun in four new States—North Carolina, Kentucky, Indiana, and Nebraska. The work has expanded very rapidly during the year, especially in Alabama and Georgia. Nearly 9,000 boys and girls are enrolled in the pig clubs in the seven States.

At the Louisiana State Fair in the fall of 1914 there was an exhibit of 185 registered hogs belonging to pig-club members. They took many prizes in open competition with the breeders' hogs.

The pig-club agents talked to about 55,000 children and teachers. A motion picture portraying the pig-club work was made. Three prints of this film are being used by the pig-club agents, along with an excellent set of lantern slides, in giving lectures on hog raising and meat curing. Marked progress in hog raising has been made in the counties in which pig clubs are organized. Formerly, a very large percentage of the pork consumed in the 11 counties of Georgia where this work is conducted was shipped in, but in 1914 these counties produced 11,000,000 pounds of cured meat, in addition to which several carloads of hogs were sold.

The hogs in pig-club communities are increasing rapidly in quality, size, and value. In Louisiana 570 hogs owned by pig-club members averaged 196 pounds and were worth \$22.26 each, while the average value for all hogs in the State was \$7.70. Hundreds of registered pigs were sold by pig-club members to farmers for breeding purposes. Over 2,000 registered hogs are owned by pig-club members, and probably 75 per cent of them are sows. Most of them will be kept for breeding purposes. In one State 168 boys each own a sow with a litter of pigs, and 80.4 per cent of them are purebreds. Seven hundred of the boys in Alabama report that they own and are feeding according to instructions 1,346 hogs. Many of the boys who

were members of the pig clubs three years ago are now in college, and some of them are paying their way on money earned by raising pigs.

Ham and bacon clubs and home-cured-meat clubs are conducted as part of the pig-club work in Georgia and North Carolina, and the members are given instructions in the home curing of meats.

#### PORK-PRODUCTION INVESTIGATIONS.

The experimental work in pork production at the experimental farm at Beltsville, Md., was in part a continuation of the 1914 work. Five tests, including 92 hogs, have already been completed in the study of the effects of copperas as an antidote for cottonseed meal poisoning in a ration partly made up of cottonseed meal.

The last experiment gave better results than any of the previous ones. Copperas fed dry at the rate of 4 grams daily per 100 pounds live weight gave slightly better results than dissolved copperas fed at the same rate. One lot of hogs had access at all times to a mixture composed of copperas 3 parts, sal soda 3 parts, Glauber salts 3 parts, common salt 3 parts, bran 3 parts, and sulphur 1 part, but this was ineffective in preventing death. The check lot revealed the usual bad effects from a cottonseed meal ration without any antidote. It has been found that it is possible to reduce somewhat the danger of poisoning by the use of copperas, but this is not an absolute preventive.

Two experiments have been conducted with the Bureau of Plant Industry in the study of replacing corn with desiccated sweet potatoes in a ration. The last experiment ran for a period of 63 days. The results indicate that sweet potatoes in this form are too bulky for hogs and that the animals can not consume a sufficient quantity to lay on good gains. Further tests will be made.

An experiment was conducted in cooperation with the Bureau of Chemistry to determine the feeding value of fish meal and tankage to supplement corn for growing and fattening pigs. Fish meal is a very effective supplement in a grain ration for pigs. In this experiment it proved equal, if not superior, to tankage. Hogs relish it and are extremely fond of it.

Plans are in progress to put into effect a project for the study of the effect of feeding forage crops on the quality of pork. A building which can be used for slaughtering purposes and for curing meat is in course of construction. This work will be done in cooperation with the Biochemic Division of the bureau, which will make the necessary chemical analyses. This work has been undertaken in view of the discrimination which appears to be made against hogs fed on certain forage crops, and the great importance of such forage crops from an economic standpoint in the production of pork. These investigations have an important bearing on the development of the swine industry, particularly in the South and in the irrigation regions.

#### HORSE AND MULE INVESTIGATIONS.

##### COLORADO WORK.

The horse-breeding experiments in cooperation with the Colorado experiment station continue successfully in the production of promising individuals, which demonstrate that the utility characteristics of the Standardbred horse can be perpetuated by proper breeding and

selection. The stallions Carmon, Albion, Wilmering, and Carnagie are being used in the stud. The stallion Defender has been leased for the season of 1915 and 1916, and will stand for service at Carbondale, Colo.

During the past year 20 animals were discarded as unsuitable to be retained for breeding purposes and were sold at auction. These included six brood mares, one 5-year-old stallion, one 2-year-old filly, eight yearling stallions, one yearling filly, and three weanling foals. All males were gelded before being sold. Two yearling geldings were retained to be used later by the station for work purposes.

Two animals were lost during the past year; the mare Iowa was destroyed because of old age and a 2-year-old filly died from pneumonia.

A feeding test with alfalfa, whereby it is hoped to ascertain if any harmful effects attend its continuous feeding throughout the year to brood mares, was begun last December. So far all mares on an exclusive alfalfa hay and pasture ration are doing well.

Fifteen foals were dropped during the fiscal year and four mares were due to foal during July.

During the 1915 breeding season 25 outside mares were bred at Fort Collins in addition to 35 mares belonging to the department and the Colorado experiment station.

#### VERMONT WORK.

At the department's Morgan horse farm, near Middlebury, Vt., 24 Morgan mares were bred and 14 foals were born during the fiscal year.

Seven of the stallions at the farm were sent to other parts of Vermont and New Hampshire for the 1915 breeding season, and one was sent to Rutherfordton, N. C.

#### ARMY HORSE BREEDING.

The plan to encourage the breeding of horses suitable for military purposes was begun, in an experimental way, in 1912. The result of this test proved a success and a definite plan was put into effect in 1913. Under this plan a form of contract was adopted whereby the owners of approved mares could breed them to Government-owned stallions, giving the Government an option on the resulting foals when 3 years old at the price of \$150 a head. Mare owners were not, however, bound to adhere to the option price, but could cancel the option at any time by paying the stipulated service fee of not to exceed \$25.

For convenience in administration this work has been divided into three districts, the first comprising the States of Vermont and New Hampshire, with headquarters at Middlebury, Vt.; the second comprising the States of Virginia and West Virginia, with headquarters at Front Royal, Va.; and the third Kentucky and Tennessee, with headquarters at Lexington, Ky.

The amounts appropriated by Congress for carrying on this work have been as follows: Fiscal year 1913, \$50,000; 1914, \$50,000; 1915, \$30,000; 1916, \$25,000.

The following table shows the results obtained from the stallions in service in the respective districts for the breeding seasons of 1913



and 1914 and the number of mares bred during the spring breeding season of the year 1915:

*Record of stallions in Army horse-breeding work.*

District.	Breeding season.	Number of stallions used.	Mares bred.	Living foals.	Aborted or dead foals.	No foals.	Mares died.	Not reported.
First.....	1913	7	279	93	24	148	.....	14
	1914	9	299	126	.....	.....	.....	173
	1915	7	<sup>1</sup> 260	.....	.....	.....	.....	.....
Second.....	1913	22	818	264	24	257	.....	303
	1914	23	966	376	.....	.....	.....	590
	1915	18	988	.....	.....	.....	.....	.....
Third.....	1913	12	423	182	30	198	13	.....
	1914	11	749	220	22	57	4	446
	1915	12	883	.....	.....	.....	.....	.....

<sup>1</sup> Estimated.

Owing to the decreased appropriation, it has been found impossible to comply with many requests for placing one or more stallions in service in other sections of the country; in fact, a curtailment for the coming year has been found necessary.

RAISING HORSE AND MULE COLTS.

The feeding experiment with horse and mule colts at the experiment farm at Beltsville, Md., has been continued throughout the year. Records have been kept of the feed eaten, with a view to compiling the results for publication.

BREEDING HORSES ON INDIAN RESERVATIONS.

The work in cooperation with the Indian Office of the Interior Department in assisting the Indians at the Cheyenne River Agency, S. Dak., to improve their horses is progressing very satisfactorily. During the fiscal year, 382 mares were bred to the light stallions.

CERTIFICATION OF PURE BREEDING OF IMPORTED ANIMALS.

Under the provisions of paragraph 397 of the tariff act of October 3, 1913, the bureau issued during the fiscal year certificates of pure breeding for 589 horses, 609 dogs, and 8 cats imported for breeding purposes.

POULTRY INVESTIGATIONS.

FEEDING FOR EGG PRODUCTION.

The feeding experiments which have been under way for some time at the Beltsville farm, to study the relative efficiency of various combinations of feed and feeding conditions, are being continued. Nine pens of fowls have been used, six of which will have completed three years under observation at the close of this calendar year. The same rations have been used from year to year. In a general way it may be said that up to this time the Leghorns lead in economy of egg production, and the results indicate that it does not pay to keep fowls

of the American breeds for egg production longer than the first laying year. The highest egg yield was secured from a pen of Leg-horns, which averaged 158 eggs each and produced eggs at a feed cost of 6.7 cents a dozen. The average egg yield of all these pens for the first year was 131.7 eggs. The egg yield for the second year was 92.7, a decline of 39. The average feed cost per dozen eggs for all pens for the first year was 10 cents and for the second year 14 cents.

Studies have been made of the feeding values of fish meal and cottonseed meal compared with beef scrap. The hens fed on fish meal have laid nearly as many eggs as those fed beef scrap for a similar length of time. Unsatisfactory results have been obtained from the pens fed cottonseed meal, only about one-half as many eggs being laid by these hens as by those fed beef scrap, while the eggs cost from 20 to 50 per cent more to produce. Some of the eggs from the pens fed cottonseed meal have had spotted and discolored yolks, which practically spoil them from a market standpoint. Experiments are being conducted to determine the cause of these discolored yolks.

#### POULTRY BREEDING.

Poultry breeding experiments at Beltsville have also been continued. The hens which were put in the trap-nest pens last year as pullets are now being trap-nested for the second year, while about 90 pullets are being trapped for their first year. Males from some of the females whose egg-production record had been determined were used in the mating last spring.

Matings have been made in an attempt to concentrate the blood of some of the better producing lines and individuals, and studies are being made of the effects of mating birds of the poorer-producing lines. Selection has also been made of some of the earlier-producing pullets, and it is planned to continue selection along this line. About 500 or 600 chickens from the various matings are being reared with which to continue the lines of breeding.

Incidentally, a considerable amount of data is being secured on the behavior of certain characters in inheritance, on the time required to break up broody hens when fed and when not fed, and on the time elapsing from going broody until laying is resumed, under both treatments. Records are also being kept on the weight of individual eggs laid by certain females during their first year of laying.

Progress has been made in the cross-breeding work, particularly in securing more chickens showing pure white plumage, a greater proportion of yellow legs, of the normal number of toes, and of red ear lobes. Some of the individuals are showing fairly well the type desired.

Two motion-picture films, showing many of the methods employed at the poultry plant, have been in almost constant use during the year.

#### POULTRY CLUBS.

Poultry clubs for boys and girls are being formed and conducted in cooperation with the States Relations Service of the department and the State agricultural colleges in Virginia, North Carolina,

South Carolina, Kentucky, Tennessee, and Georgia. In these States the work is organized in 98 counties, with a total of 3,722 members, who set 11,860 eggs, hatched 8,595 chicks, and matured 6,402 fowls. The poultry-club work has shown a steady increase from year to year and has created a widespread interest in poultry in the States where it is conducted.

The limitations of a report of this nature make it impossible to give many details of the actual work which is being done by these children. It may be said in a general way that the poultry clubs are proving a nucleus and a stimulus for the development of the poultry industry in the sections where they are organized and are enabling children to earn some money for themselves, as well as to assist their families in raising on the farm some of the food required for the family table. There are many instances of poultry-club members selling from \$50 to \$100 worth of poultry products during the season, besides building up their flocks. One of the good features of this work, as with that of the pig clubs, is an indication that the children plan to make their club work a means of earning money to get an education.

#### COMMUNITY BREEDING OF POULTRY.

The community poultry-breeding efforts, started last year at three points in Virginia (Middletown, Frederick County; Farmville, Prince Edward County; and Waverly, Sussex County), are steadily progressing. The first two communities named are breeding Barred Plymouth Rocks, while in the latter county the Single Comb White Leghorn has been taken up. No other breeds are being kept in these communities by club members.

#### INFERTILE EGGS.

The campaign for the improvement of farm eggs has gone forward. The production of infertile eggs is advocated, as these eggs have much better keeping qualities than ordinary fertile eggs. "Rooster day" campaigns, to increase the production of infertile eggs by disposing of roosters, have been held in many States. About 50,000 of the department's placards pointing out the losses due to fertile eggs and advocating the production of infertile eggs have been distributed.

#### TURKEYS AND GUINEA FOWLS.

Last fall and winter a careful survey of the conditions of turkey and guinea raising was made for the purpose of learning the different methods used by successful growers of the birds, especially turkeys. Since February investigations in feeding, breeding, and incubation, both natural and artificial, have been conducted on a farm in a large turkey-producing section of Texas.

#### OSTRICH INVESTIGATIONS.

The ostrich investigations which have been under way for some time in the Salt River Valley of Arizona are being continued. The



object is to study the economy of the ostrich industry, the proper handling of birds, the production of high-grade feathers, and the proper handling of feathers to realize the largest returns when sold. To enable the bureau to have control over the feeding and breeding experiments 11 birds were purchased in December, 1914, and these are quartered on a large ranch near Glendale, Ariz., in cooperation with the Arizona Ostrich Breeders' Association. Four of these birds are South African, two are Nubian, and five are crosses of the Nubian and South African breeds. In addition a large number of ostriches owned by members of the association are available to the bureau for experimental purposes. Several chicks belonging to the department have been hatched, also 60 which are the property of the cooperators. Feeding studies will be made with these chicks.

#### SHEEP AND GOAT INVESTIGATIONS.

The service attempted in 1915 for the sheep and goat industries, as in 1914, was mainly of an investigational character.

#### PREPARATION OF WOOLS.

Considerable progress has been made in the work on classification of wools. This project originally provided for investigations in the woolgrowing States and the market centers and for the dissemination of the findings among woolgrowers. The discussions of the wool conference held in June, 1914, made it apparent that methods of preparing wool for market in accord with present classifications could well be included in the investigations. The latter phase of the woolgrower's work is intimately associated with his methods of breeding, and one necessarily involves the other. As a part of an educational plan to improve methods of handling wool, Department Bulletin 206, "The Woolgrower and the Wool Trade," was issued and has been widely distributed among woolgrowers. Methods of breeding sheep and preparing wool as observed in Australia and the adaptation of that country's methods to conditions in the Western United States are discussed in a later paper now in course of publication. As a further part of such educational work arrangements have been made for use in the field of the division's wool exhibit in cooperation with extension departments of the agricultural colleges.

#### RANGE SHEEP BREEDING.

The range sheep-breeding experiments in Wyoming have been given special attention. The flock was under the personal observation of an animal husbandman most of the year. Full notes have been taken with a view to the study and publication of the results.

An important change has been made in the method of recording the weights of fleeces. In addition to taking the gross weight of the fleece and the length of the fiber, a 10-ounce sample is now withdrawn. This sample will be separately scoured by a method that will show separately the shrinkage due to oil and to dirt. This and other methods furnish accurate data concerning the quantity and value of wool produced by various types of sheep. Such informa-

tion has not heretofore been available, and it will serve as a guide in the development of the type suited to the range country.

In March, 1915, the crossbred ewes dropped their first crop of lambs. The crossbred flock contains ewes sired by Lincoln, Leicester, Cotswold, and Romney Marsh rams. The yield of lambs was an excellent one. On the basis of carcass weight, mutton conformation, and yield of wool, the Lincoln cross ranks first and the Cotswold second, while the Leicester and Romney Marsh produce the finest quality of wool, but are below the others in weight of fleece and in mutton points.

The flock at Laramie numbers 500 breeding ewes.

#### CORRIEDALE SHEEP.

Under the terms of an appropriation "for the importation of Corriedale and other promising breeds of sheep for breeding purposes," 65 Corriedale ewes and 10 rams were imported from New Zealand and are being kept in Wyoming. These sheep represent a fixed and true breeding type of sheep quite similar to those now bred in the Western States, but which are not a fixed type and are produced only by the use of two pure parent stocks. Considerable interest has been manifested in the bureau's test of the adaptability of this breed to our Western State conditions.

#### EXPERIMENTS AT BELTSVILLE.

Attention is being given at the Beltsville farm to the keeping of sheep upon forage crops, as it seems certain that the farm sheep industry of the future must be based largely upon rotation forage crops. This plan insures economy of production by reducing to a minimum the area of land required and the labor costs of harvesting feeds. A field of 30 acres has been divided into parts of from 1 to 5 acres each for seeding to fall grains for pasture and to peas, oats, rape, etc., for later forage. The aim is to increase the number of sheep reared upon this land to the maximum number consistent with regular farm practice.

All the animals used in the experiments in the production of Persian lamb fur, as well as those used in breeding an early lambing type of mutton sheep, were lost in a fire that destroyed the sheep barn at Beltsville on March 31. These two projects have therefore been abandoned for the present. The results of our four years of experiments with the Karakule sheep used in the first-named project have been prepared for publication. Most of the ewes bred to Karakule rams were of Barbados breeding. None of the skins from lambs of the first cross were of commercial value for fur, but half-bred ewes bred to Karakule rams had produced lambs with skins sufficiently good to make it appear that continued crossing for a higher proportion of Karakule blood would show that the production of Persian lamb fur in the United States might be made practical and profitable. Of the limited number of lambs secured by mating Karakule rams to Border Leicester, Cotswold, Cheviot, and Merino ewes none had valuable skins, though one lamb sired by a Karakule ram and out of a first-cross Karakule Cotswold ewe yielded a skin worth \$4.

Good progress has been made in the experiments in breeding milch goats. Forty-two does are being milked throughout their lactation periods, and their milk yields show that the offspring of native American does and pure-bred Saanen and Toggenburg males are quite satisfactory as milk producers. Arrangements are being made with suitable institutions to make thorough tests of the reputed value of goat's milk for the feeding of infants and invalids. The bureau now has thirty-five 2 and 3 year old half-bred does, 26 yearlings, and 24 kids, the latter group containing a number having three-quarters Saanen blood.

#### NEW ENGLAND SHEEP BREEDING.

The Southdown flock at the Morgan horse farm, Middlebury, Vt., now numbers 150 head. Each year a number of rams and ewes are being sold to New England farmers, and their appraisal of the stock is reflected in higher prices offered at the annual sales.

Internal parasites still affect the flock, as is likely to be the case with any flock after a few years' stay upon the same land, but only one or two lambs have been lost from this cause, and the others have all made excellent growth. The methods of prevention call for the same practices as are necessary to economical production. These practices, using forages and rotation of pastures, have been followed during the past two seasons.

#### BELTSVILLE FARM.

The work at the experimental farm during the year has been continued under the same plans as formerly, the farm being the field laboratory for the division for experimental purposes. The farm is being systematically drained, as it has been found that without such tile drainage considerable time is lost every year on account of water standing on the land.

A small house for housing breeding pens has been completed at the poultry plant, and a building has been erected at the hog plant for slaughtering and curing meats.

On the night of March 31 the sheep barn was totally destroyed by fire from an unknown cause. A high wind was blowing at the time, and nothing could be done to save the structure. One hundred and thirty-nine sheep were lost in the fire.

#### ANIMAL NUTRITION.

The investigations in animal nutrition, in cooperation with the Pennsylvania State College, which have been in progress since 1899 and have consisted in studying the nutrition of beef cattle, have been changed in character so as to devote the study in the future to the metabolism of milk production. As investigations on the latter subject are properly a function of the Dairy Division of the bureau, the work has been transferred to that division, and the phases pertaining especially to beef production have been terminated.



## THE DAIRY DIVISION.

The work relating to the dairy industry is carried on by the Dairy Division under the direction of Mr. B. H. Rawl, chief.

As part of the varied activities of this division public meetings of many kinds are attended by its representatives. During the year such meetings numbered 1,679, and included fairs, exhibitions, conventions, farmers' institutes, schools, short courses in dairy instruction, lectures, and meetings of associations, clubs, etc.

All field work is conducted on the basis of cooperation in some form with State authorities. The only exception is the dairy demonstration farm at Denison, Tex., which is conducted in cooperation with a local corporation formed for the purpose, under the auspices of the chamber of commerce. Where the work of a field agent is general the expense is borne by the department, but when a field man is assigned to work confined to a particular State the support of the work is, in most cases, placed on the half-and-half basis, the department and the State each contributing one-half of the expenses.

The field men who are on the half-and-half basis are dairy specialists and are regularly assigned to the extension forces of the States in which they operate. The movements of the dairy specialists are directed by the State extension director, and his work is closely associated with that of the extension organization, including the county agents. The line of work to be followed by the dairy specialists is mutually agreed upon in advance by the Dairy Division and the extension department, with the approval of the States Relations Service of the department. The Dairy Division gives sufficient supervision to the work to see that it is conducted as planned and to see that it receives all the aid that the division can render. Under this plan the specialist gives guidance to the activities of the entire extension force so far as they relate to dairy work.

Thus far this plan has worked excellently. During the fiscal year cooperative work was carried on in 24 States, as follows: Alabama, Arkansas, Georgia, Idaho, Iowa, Louisiana, Maryland, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Oklahoma, Oregon, South Carolina, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, and Wyoming.

The construction of silos gives some indication of the progress of dairy development. During the year 546 silos were erected with the advisory assistance of the Dairy Division.

### DAIRY FARMING INVESTIGATIONS.

The work in dairy farming has continued in charge of Mr. Helmer Rabild.

To the work previously carried on some new lines have been added, viz, field work in the tick-free sections of the Southern States, and field work in Nebraska, West Virginia, Tennessee, Arkansas, and Oklahoma. The total number of field men has been increased to 47, most of whom are permanently engaged.

### SOUTHERN DAIRYING.

The past year has seen the greatest interest in and development of the dairy industry ever known in the South. Large numbers of men

new to the business have gone into dairying. Creameries have been built and cream routes established on a firm basis, and the farmers have received large sums of money from sales of dairy products at a time when the old standard money crop—cotton—was failing to be profitable.

The new conditions call for changes in extension methods. It is becoming necessary in many localities to shift the work from the individual to the community basis, and where formerly elementary principles were dealt with, now definite information concerning specific problems must be supplied.

To make the greatest use of existing market centers, and to allay the demand for creameries where the time was not ripe for them to succeed, as well as to give farmers specific help in getting into dairying, much time has been spent in the organization of 40 routes for collecting cream. It is the policy to ship cream to the nearest market until sufficient support for a creamery can be developed in the section traversed by the route. The new creameries at Mooresville, N. C., and Selma, Ala., are the result of this policy. The field men use these as centers for instruction through the rural schools, and by means of meetings and short courses in dairying. The quantity of butter fat already available for collection, as shown by the creameries and cream routes now in operation, is surprisingly large, and shows the need for better markets for the milk and cream that farmers are now ready to produce.

Creameries have been established at agricultural colleges with which field men are working in South Carolina, North Carolina, Tennessee, and Alabama, and the organization of a plant in connection with the Louisiana State University is assured. These college creameries have created enthusiasm among the students, the people of the respective States, and the college authorities themselves. With the help of the cream routes the South Carolina college creamery has developed in 10 months from 1 patron with 4 cows to 209 patrons with 758 cows, and of these patrons 85 or more are new to dairying. There are 10 cream routes, and the cash paid patrons during the month of June was \$3,780, nearly \$20 apiece. The college creamery in Alabama, started under great difficulties, has resulted in a private creamery at another point, Selma, and in a cream-shipping business which has attracted to dairying many people not engaged in it before.

Where the Texas-fever ticks have been eradicated there is an opportunity for the introduction of improved methods of keeping live stock. In a number of cases men have been appointed for the special purpose of working in a limited portion of the State, where the ticks have been eliminated.

#### COW-TESTING ASSOCIATIONS.

The cow-testing associations are on a firmer footing than they have been in previous years. Early in the fall five new men were appointed to do field work with these associations, but with the outbreak of foot-and-mouth disease all these men were detailed to quarantine work. This disease has been disastrous to the cow-testing-association work; many herds belonging to members of associa-

tions have been slaughtered, and a number of associations were temporarily discontinued because it was not deemed advisable to run the risk of spreading the disease by having the tester going from herd to herd.

During the year 81 new associations were formed, while 32 ceased operations. This leaves a total of 210 active associations with 5,573 members owning 105,526 cows, or an increase of 30 per cent over the 161 associations reported active last year.

A few of many instances of benefit from cow-testing-association work may be cited. Two associations in Maryland which have run for 3 and 4 years, respectively, show an average increase of 21 and 14 pounds of fat per cow per year, which is sufficient to pay for the work for a longer period than the total time the associations have been in operation. In a herd in Maine the average quantity of milk produced per cow has increased in 5 years from 5,594 to 8,649 pounds, an average increase of 611 pounds a year. The fat increased on an average of 16.6 pounds a year. The owner of another Maine herd stated that the value of his herd had been doubled and the net profit per cow increased 50 per cent.

#### COMMUNITY DEVELOPMENT OF DAIRYING AT ALGONA, IOWA.

The experiment in the community development of dairying at Algona, Iowa, shows a steady improvement in conditions and methods, both in the creamery and on the farms. The object of this experiment is to determine whether or not the business of a creamery can be increased enough by a competent field man working among the patrons to enable the creamery to pay the expenses of such a man. During the first 10 months of the past year the creamery sold more sweet cream than ever before during the same length of time, and could not fully supply the demand. The premium of 3 cents a pound of butter fat for sweet cream is still allowed. The prices paid to patrons have been equal to those of other creameries with twice as much business, and 2 or 3 cents more than prices paid by other creameries of the same size. A Holstein breeders' association has been organized.

The number of silos in the community was nearly doubled, 14 having been erected. The production of butter fat increased about 8,000 pounds over the year before, partly due to the increased number of silos. The cow-testing association has been maintained with good interest. Sales of cows and bulls show a marked advance in prices, due to the records, and the acquisition of improved dairy stock from outside continues. Progress has been made in getting owners to test their herds with tuberculin. There has been much improvement in feeding methods and in the kind of crops grown.

#### DAIRY DEVELOPMENT IN NEBRASKA.

Field work for the development of dairying in Nebraska was begun August 1, 1914, in cooperation with the State University. The field man has given much time to farmers' institutes. Work for the improvement of city milk supplies has been done at several places. A bank is offering cash prizes for cow testing by boys and



girls in schools with which the field man is working, and a commercial club is supplying capital for the purchase of cattle to be sold at cost to the farmers on long time.

#### DAIRY DEMONSTRATION FARM, DENISON, TEX.

A dairy demonstration farm located about 3 miles east of Denison, Tex., owned by a company organized by the Denison Chamber of Commerce, is operated under a cooperative arrangement by which the Dairy Division provides a manager and the company pays all other expenses. The object is to show what can be done under ordinary conditions by correct methods of dairy farming.

From a typical worn-out cotton farm in 1908, stocked with ordinary native or scrub cattle, the farm and herd have been improved until the soil is very rich. Forage and silage crops are now grown; the herd has been improved by the use of pure-bred Jersey bulls and by record keeping and selection; the average production of butter fat has been practically doubled. The original cows numbered 44. There are now on hand 98 females, including 2 of the original herd, 48 milch cows, and 48 heifers.

#### MARKET-MILK INVESTIGATIONS.

The work of the section of market-milk investigations, of which Mr. Ernest Kelly is in charge, is largely educational in character, and is carried on mainly in cooperation with city health departments, with the object of improving local milk conditions.

#### CITY MILK SUPPLIES AND MILK IMPROVEMENT.

In the past year the Dairy Division has lent active aid in improving the milk supplies of 20 cities situated in 11 States. In this work 446 dairy farms and 37 milk plants were scored, nearly four times as many as in the preceding year. Nearly 300 cities are using some form of the score card for dairy farms.

The Dairy Division has entered into a cooperative agreement with the Office of Markets and Rural Organization to study the handling and delivery of milk in cities, which will be a continuation of work previously carried on by this division.

Data have been collected on the cost of filling and capping milk bottles. Forms have been devised and published for milk dealers to use in checking up their goods. Every month a circular letter on topics pertinent to milk handling is sent to all milk dealers requesting it; the number now receiving this letter is about 600.

At Cumberland, Md., three employees of the division spent some time making a thorough survey and introducing efficient inspection. Cooperative work in the Mississippi Valley has been begun with the Bureau of Chemistry, and a party of department experts is traveling in that section, doing educational work among the dairymen.

A study of the relation of bottle caps to the presence of bacteria and to the flavor of milk has been made. A new bacterial rating for scoring milk has been worked out and embodied in a new score card, more uniformly and widely applicable.

The work of taking samples and indorsing permits for the delivery of milk in certain Government buildings in Washington, D. C., has been continued. Five dairies now hold such permits. Where dairies hold permits a monthly inspection and a weekly bacterial count are made. During the year 38 inspections were made and 236 samples were taken for bacterial count.

#### MILK CONTESTS.

Fifteen milk contests have been held in 14 cities. The number of contests and the number of samples scored are about twice as large as those of the preceding year. These milk contests have given opportunity for a wide range of observations as to the fat content of milk. In 1,810 samples of milk the average fat content was 4.34 per cent.

#### CONDITIONS OF MILK PRODUCTION.

A study of the solubility of manure in milk and the amount of manure that is removed by different methods of straining is being made. Microphotographs have been made of cheese-cloth and wire strainers, showing the impossibility of straining out bacteria and much of the finer dirt.

Investigations are being made into the cost of milk production. Forms for this work have been prepared and given a trial in Maryland. Cooperative agreements for the same purpose have been signed with the North Carolina experiment station and the extension department of Purdue University, Indiana.

Experiments with regard to the flavor of milk as affected by feeds have been made at the Beltsville farm. The experiment with high and low protein feeds was inconclusive. No difference was noted in the effect of wet and dry beet pulps. Between beet pulp and ordinary grain feed there was the difference that the milk from beet pulp tasted better than the other when fresh, but after being held five days had a pronounced, abnormal, brown-paper flavor. Milk from fish meal, on the other hand, had an abnormal flavor when fresh, but was preferred by the judges after it was five days old.

#### DAIRY MANUFACTURING INVESTIGATIONS.

The work relating to dairy manufacturing, in charge of Mr. S. C. Thompson, includes creamery management and demonstrations, cheese-factory investigations, the development and improvement of farm-butter production, the inspection of renovated butter and of the factories producing it, and the supervision of butter for the Navy.

#### CREAMERY OPERATIONS.

Monthly and annual reports from the creameries are carefully examined, and suggestions based on the annual reports were this year made in a personal letter to each secretary instead of in a circular letter. A monthly circular letter to creameries has been the occasion of many improvements. In addition a circular letter for distribution to patrons, sent to the reporting creameries desiring it, has reached a circulation of 14,000 a month.

An accounting system for creamery use has been formulated, so as to meet the difficulties of keeping accounts when the work includes side lines, such as ice-cream making, handling eggs, feeding hogs, and selling cream.

An experimental creamery has been established at Grove City, Pa., in cooperation with the commercial club of that city, and with the support of the farmers of the vicinity. A local company furnishes the building and equipment and handles the finances, the work being under the direction of the Dairy Division. As the new building could not be finished before July, a temporary creamery was fitted up and operations were begun May 3.

Special assistance has been given to creamery work in a number of localities. A campaign among the patrons of the creamery at Brooklyn, Iowa, to encourage the planting of alfalfa for feed, resulted in 75 acres being sown in the fall of 1914. A cow-testing association also was organized. At Mora, Minn., assistance was given in preparing balanced rations and in the erection of 22 silos. Several patrons have begun keeping herd records. In connection with the Waynesboro, Va., cooperative creamery two breeding associations have been formed, one Guernsey and one Holstein. This creamery is now in a very prosperous condition, having made as high as 30,000 pounds of butter a month. It has enlarged its plant in accordance with plans from the Dairy Division. The cooperative creamery at Eatonton, Ga., was transformed from an insanitary, poorly equipped plant to a modern, well-equipped, sanitary creamery, with a suitable system of accounting. A creamery at Chapel Hill, Tenn., built by promoters at a cost of twice its value, was developed from a state of inactivity into a prosperous creamery, making 2,500 pounds of butter a week.

#### BUTTER MARKETING.

The investigation of butter marketing is done in cooperation with the Office of Markets and Rural Organization of the department. This work receives the service of one man from the Dairy Division. About 100 creameries were visited in Minnesota, and net prices were compared with the quality of the product. Two weeks were spent in studying market practices in Chicago, learning the margin of profit on butter handled by various dealers, the relationship between grades and prices, the sources of butter supply, etc. Similar investigations were made in New York, Philadelphia, St. Paul, and Minneapolis. A trip was made through the South to investigate the present facilities for marketing dairy products, and to study the difficulties in marketing local butter as compared with that brought from the North.

#### CHEESE MANUFACTURE.

Correspondence was maintained with a large number of cheese factories, and reports for 1914 were received from factories producing an aggregate of over 65,000,000 pounds.

Following an investigation by a representative of the Dairy Division into the possibilities of starting a cheese industry in the mountains of North Carolina, two cooperative factories were started, one



at Sugar Grove and the other at Grassy Creek. The former began with 700 to 1,000 pounds of milk a day, much more than was expected. Other communities have asked for similar assistance.

#### NAVY BUTTER.

During the year 990,764 pounds of butter was packed for the Navy Department, in 5-pound cans and in tubs, under the supervision of the Dairy Division. The butter packed in tubs (300,144 pounds) was made and stored under the same conditions as the tinned butter, and was found to have just as good keeping qualities. The increase in the capacity of the cans from 3 to 5 pounds has effected a saving in the cost of the cans, and the larger size has proved equally satisfactory for the use of the Navy.

#### INSPECTION OF RENOVATED BUTTER.

During the year twenty-six factories were bonded as manufacturers of renovated butter. All were inspected regularly, either by a representative of the Dairy Division or by inspectors in the meat-inspection service. The total output during the year was 39,237,725 pounds, which was 7,048,386 pounds more than the year before. Exports of 1,918,015 pounds were made under certificate, an increase of 1,252,285 pounds.

From the standpoint of sanitation, the condition of the factories ranges from satisfactory to poor. Two of the poorest plants have ceased operation, while another has changed hands and improved greatly.

#### WESTERN DAIRY INVESTIGATIONS.

The dairy industry is making great progress in the territory covered by the western office of the Dairy Division under Mr. J. E. Dorman.

#### DAIRY FARMING.

Field work in dairy farming was carried on in Montana, Nevada, Utah, Oregon, New Mexico, North Dakota, Washington, Wyoming, and Idaho. Work has been concentrated in selected and well-distributed counties in each State, with the result of inducing substantial development in those counties, from which the improved methods may be expected to spread to the surrounding regions. For instance, the Dairy Division in 1913 assisted in building the first silo in the State of Utah; in the following year 30 silos were built in the same county.

At the Utah State fair an exhibit was made of a model of a dairy barn, and many requests for plans resulted.

Plans furnished for dairy buildings during the year numbered 70. Sixty silos were built with the direct aid of the division, and 127 with indirect assistance.

Much has been done to promote the keeping by farmers of records of the feed, production, etc., of their herds as a basis of improvement and economy, and the results have been very beneficial. Herd records have been used for observations and experiments on the economy of different feeds.

Seven new cow-testing associations were formed in the western territory, with a total of 3,309 cows. Four of these associations were in Oregon, 2 in Washington, and 1 in Nevada. Many old associations were reorganized. The work of these organizations has brought about a spirit of cooperation and stimulated an active interest among dairymen in such subjects as pure-bred sires, balanced rations, sanitation, dairy literature, and farmers' institutes. Three bull associations have been organized and 9 excellent bulls purchased.

Data have been collected on the economy of feeding silage as compared with alfalfa hay, which is plentiful and is likely to be fed too exclusively. Practical dairymen who have been studying the question are unanimous in the view that 30 pounds of silage can be substituted for 20 pounds of alfalfa hay with better results than would be obtained from the hay alone, although these feed values do not coincide with those which authorities ordinarily assign to the feeds mentioned.

#### CREAMERIES AND CHEESE FACTORIES.

Much good has been accomplished by the efforts to improve creamery practices. The western office has been called on to aid in the establishment of cooperative creameries and cheese factories. The cooperative creamery at Caldwell, Idaho, organized under the guidance of the Dairy Division, has been in successful operation for a year, and the output is approximately 1,000 pounds of butter a day. The patrons are receiving good returns and their herds are being rapidly increased and improved. At least two other cooperative creameries and one cooperative cheese factory have been started in Idaho as a direct result of the demonstrated success at Caldwell. Not all localities, however, are suited for cooperative plants.

#### MARKET MILK IMPROVEMENT.

Nine contests for the improvement of market milk were held. In a number of cases troubles with flavor of milk, etc., have been investigated and remedies recommended. Help has been given to cities in drafting milk ordinances. Some scoring of dairy farms and milk plants has been done at the request of city authorities.

#### WORK WITH SCHOOLS.

Cooperation with county agents and public schools has been closer than ever before. A district school in Nevada has installed a Babcock tester for the use of pupils. At a dairy school in connection with the high school at Kalispell, Mont., 17 boys were given instruction by the field agent on five days of each week for three months.

Some notable work has been done with grade schools in Oregon. Fifteen school districts in Polk County provided Babcock testers. Cow demonstrations and scoring contests were held at the school rallies. Not only school children, but teachers, farmers, and business men took part in the judging and scoring of cows, both at the schools and at home. Four other counties took up the work, until 40 testers were in use at as many different schools, while the boys and girls kept records of their parents' cows.

In Utah, also, cooperation with seven high schools and many grade schools in milk testing and record work is bringing good results.

#### RESEARCH LABORATORIES.

The work of the research laboratories, in charge of Mr. L. A. Rogers, was seriously interrupted by the rearrangement and extension of the laboratories. These improvements, however, now nearly completed, provide exceptional equipment and are expected to obviate the necessity for any important changes or additions for several years.

The new experimental creamery at Grove City, Pa., has been erected by a corporation at a cost of approximately \$30,000 and leased to the department. The laboratories contained in the plant were equipped by the department and include two chemical laboratories, a bacteriological laboratory, an experimental butter room with duplicate equipment, a vacuum pan for producing bulk condensed milk, a casein equipment including a vacuum drier and twin tunnel driers, and an experimental sewage disposal plant.

The laboratories at the experimental farm at Beltsville, Md., now nearly completed, will suffice for the bacteriological work which has to be done at the farm and for the new work on milk secretion.

#### BACTERIOLOGY OF MILK.

On the question whether pathogenic streptococci survive pasteurization there is great difficulty in distinguishing between the pathogenic and nonpathogenic types, but the present results indicate that the former are destroyed by approved pasteurizing temperatures.

A new method of measuring acid formation has been found to be of distinct advantage in studying the streptococci as well as the so-called alkali bacteria.

Work on the colon group of bacteria has demonstrated that this is a heterogeneous group of sharply defined types which may be separated.

It has been determined that the bacteria which are generally distributed in the udder are of the streptococcus type, the *Staphylococcus pyogenes* type, and the *Bacillus abortus*. The last-named organism has been found in the udder of one or more cows in every herd examined, and in some cases it appears to be virulent.

#### ICE CREAM.

It has been demonstrated that various constituents have marked influence on the flavor of ice cream. It has been proved that bacteriological counts can be made well within the usual limits of error.

#### CONDENSED MILK.

Knowledge of conditions and problems in the condensed-milk industry has been acquired, and facilities are being prepared at Washington and Grove City for the investigation of such problems.



## BUTTER INVESTIGATIONS.

The work on butter continues to support earlier results. Recent results indicate that the amount of curd in butter has a direct relation to its keeping quality, not by furnishing more food to bacteria, as has been supposed, but by reason of the oxidation of some constituent of the curd.

## CHEESE INVESTIGATIONS.

Material advance has been made in studying the conditions under which bacteria grow in the Swiss type of cheese, particularly their relation to the acidity of the medium. We have become able to control the quality of Swiss cheese even under adverse factory conditions. Cheese of excellent quality was made last fall in a Wisconsin factory after all other factories had been obliged to close for the season. A method has been developed for the colorimetric estimation of hydrogen-ion concentration which will be of great value in the study of the growth of bacteria and their relation to acidity of the medium.

Further studies have made it possible to obtain with considerable certainty a proper growth of mold in Roquefort cheese, but the proper method of accomplishing a correct and uniform salting has not been perfected. It has been found that while there is some difference in the fat of cows' milk and sheeps' milk it is not great enough to make any real difference in the product.

## OTHER INVESTIGATIONS.

Unsatisfactory conditions have prevented conclusive results regarding the effect of silage on differently treated concrete, but it has been made clear that a very appreciable amount of cement is dissolved by the silage juice.

It has been shown conclusively that nitrogenous matter is carried from the upper to the lower layers of the silage by seepage of the juice.

An experimental plant for sewage disposal is being constructed at Grove City, which will include types of the three most approved methods. These will be operated by the United States Public Health Service. Similar arrangements are planned at Beltsville.

## DAIRY EXPERIMENT FARM AT BELTSVILLE, MD.

Several lines of experiment have been carried on at the Dairy Division experiment farm at Beltsville, Md., of which Mr. T. E. Woodward is in charge.

An experiment with fish meal for feeding cows indicated that this feed produces more milk than cottonseed meal, but about the same quantity of fat, the percentage of fat in the milk being lowered. The cows will eat it, but do not like it.

Twelve young calves were fed with cold skim milk, warm skim milk, and with cold and warm alternately. It appears that the cold skim milk gives less satisfactory results than the warm or alternat-

ing; at the same time, none of the calves had scours, a symptom which is commonly believed to be produced by cold skim milk.

A test of iron compounds to overcome the toxic properties of cottonseed meal showed that the iron compounds failed to accomplish the object intended.

Effort has been made to ascertain what constituent of prickly pear is responsible for the diminished percentage of fat in milk when that feed is used. The results indicate that the quantity of water taken in the pear is not alone the cause of the reduction. The fact that fish meal had the same effect on the fat content strengthens the belief that mineral elements are the cause; yet when bone meal was used this in itself did not decrease the fat percentage.

It was found that beet pulp injures the flavor of milk if the milk is held for several days.

Work with the Office of Public Roads and Rural Engineering is being conducted to ascertain the best materials, mixtures, and coatings for concrete silos.

During the year the east wing of the cow barn was remodeled, the west wing and administration building were completed, and a large open cow shed was built.

#### DAIRY ARCHITECTURE AND ENGINEERING.

A new plan has been prepared for a cheap dairy stable to meet certain conditions in the South, and this has been found very helpful in the field work. Plans and specifications were also prepared for a combination creamery and milk-shipping station to be used in the New England States. Blue prints of plans already in stock, aggregating 970 sets, have been sent out on request.

Plans have been drawn, and in many cases specifications, bills of material, surveys, and inspection service have also been furnished, for construction and engineering work in connection with various enterprises of the division and some outside of the division, including building construction, road making, electrical equipment, refrigeration, machinery, and water supply. Such work was done for the dairy demonstration farm at Denison, Tex.; the live-stock experiment farm at New Iberia, La.; the experiment farm at Beltsville, Md. (including mess house, small animal house, 30,000-gallon concrete reservoir and cooling tower, house for fire apparatus, heating system for superintendent's house, refrigeration and dark-room equipment for administration building, electrical equipment, refrigerating plant, and pumping plant); the Naval Academy dairy at Gambrills, Md.; the experiment creamery at Grove City, Pa.; laboratories at Washington for the Dairy Division and the Bureau of Entomology; refrigerating plants for the Bureau of Animal Industry and the Bureau of Plant Industry; and for a city milk plant to be located at Louisville, Ky.

Experimental work has been done on pasteurization of milk in bottles by means of circulated hot air.

Some of the architectural and engineering work has been transferred to the Office of Public Roads and Rural Engineering, and the future work of the Dairy Division on these subjects will be mainly of a research nature.

## NAVAL ACADEMY DAIRY.

As in previous years, the Dairy Division has cooperated with the United States Naval Academy at Annapolis in the conduct of the dairy farm operated by the academy to supply the midshipmen's mess. The academy has bought a new farm of about 750 acres at Gambrills, Md., about 10 miles from Annapolis, the original location close to the academy not affording sufficient room to grow feed. The Dairy Division has given advice and drawn plans for the construction of buildings and roads on the new farm, devised cropping plans and a cost-accounting system, scored the dairy monthly, and made counts of the bacteria in the milk. The bacterial counts have generally been found low.

## THE MEAT INSPECTION DIVISION.

The Meat Inspection Division, of which Dr. R. P. Steddom is chief, carries on the Federal meat inspection.

The statistics for the fiscal year 1915 show marked increases in nearly all respects. There was a slight increase in the number of animals slaughtered, a considerable increase in the quantity of products prepared under inspection, and a very large increase in the export shipments of meat and meat food products.

New meat-inspection regulations, carefully revised in the light of the latest scientific knowledge and several years' experience in administering the service, were issued by the Secretary of Agriculture under date of July 15, 1914, to take effect November 1, 1914, except the portion relating to imported meats, which became effective January 1, 1915.

## INSPECTION OF DOMESTIC MEATS.

Inspection was conducted at 896 establishments in 247 cities and towns, as compared with 893 establishments in 244 cities and towns during the preceding fiscal year.

Inspection was begun at 77 establishments and withdrawn from 101 establishments, as compared with 101 and 74, respectively, during the fiscal year 1914. The causes of withdrawal were as follows: Discontinuance of slaughtering or of interstate business, 82 establishments; failure to comply with the requirements of the department, 9; by request, 6; consolidation with other establishments, 2; granting of market inspection, 2.

Statistics of the meat inspection for the fiscal year are given in the tables that follow:

*Ante-mortem inspections of animals.*

Class of animals.	Passed.	Suspected. <sup>1</sup>	Con-demned. <sup>2</sup>	Total inspected.
Cattle.....	6,901,838	63,408	169	6,965,415
Calves.....	1,758,458	2,943	439	1,761,840
Sheep.....	12,946,828	3,538	39	12,950,405
Goats.....	165,734	61	5	165,800
Swine.....	36,247,498	132,204	8,700	36,388,402
Total.....	58,020,356	202,154	9,352	58,231,862

<sup>1</sup> This term is used to designate animals found or suspected of being unfit for food on ante-mortem inspection, most of which are afterwards slaughtered under special supervision, the final disposal being determined on post-mortem inspection.

<sup>2</sup> For additional condemnations see succeeding tables.



*Post-mortem inspections.*

Class of animals.	Passed for food.	Passed for sterilization.	Condemned.	Total.
Cattle.....	6,903,123	8,783	52,496	6,964,402
Calves.....	1,729,927	34	5,941	1,735,902
Sheep.....	12,890,791	687	17,611	12,909,089
Goats.....	164,876	4	653	165,533
Swine.....	35,919,291	114,762	213,905	36,247,958
Total.....	57,608,008	124,270	290,606	58,022,884

The number of swine slaughtered during the year is the largest since the inspection was instituted, and an increase of 11.3 per cent over the average for the previous eight years.

*Diseases and conditions for which condemnations were made on ante-mortem inspection.<sup>1</sup>*

Causes of condemnation.	Cattle.	Calves.	Sheep.	Goats.	Swine.
Blackleg.....	2	1			
Dropsy.....					3
Emaciation.....	1	2	3		31
Foot-and-mouth disease.....	20				1,554
Hernia.....					4
Hog cholera.....					7,001
Immaturity.....		399			2
Injuries.....	14		1		1
Moribund.....	124	37	33	5	88
Pneumonia, enteritis, etc.....	6				10
Recent parturition.....	1				
Septicemia.....			1		
Sexual odor.....					1
Tetanus.....	1				
Toxicosis.....			1		
Tumors and abscesses.....					5
Total.....	169	439	39	5	8,700

<sup>1</sup> This table covers only the period from Nov. 1, 1914, when the new meat-inspection regulations containing new provisions for condemnation on ante-mortem inspection became effective, to the close of the fiscal year.

*Diseases and conditions for which condemnations were made on post-mortem inspection.*

Causes of condemnation.	Cattle.		Calves.		Sheep.		Goats.		Swine.	
	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.
Actinomycosis.....	598	123,158	12	1,084						
Adenitis.....									7	
Anthrax.....									1	
Asphyxiation.....	7		3		69				996	
Atrophy.....		1			1				2	3
Autointoxication.....	6				1				2	
Blackleg.....	8		3		1					
Bone diseases.....	4	7	1						52	3
Caseous lymphadenitis.....					4,307	38	209	13		
Cellulitis.....									20	567
Congestion.....	10		1		9		1		152	
Contamination.....	4	1,437	2	46	1	8			185	10,459
Cysticercus.....	413	1,477	20	9	223	28			97	
Dropsical diseases.....	15	3	2		29		2		70	
Emaciation.....	6,360		760		4,318		326		904	
Exhaustion.....	3				2				2	
Foot-and-mouth disease.....	834				216				516	

*Diseases and conditions for which condemnations were made on post-mortem inspection—Continued.*

Causes of condemnation.	Cattle.		Calves.		Sheep.		Goats.		Swine.	
	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.
Frozen.....									17	.....
Gangrene.....	266		23		15		1		27	.....
Hernia.....	3				6				89	.....
Hog cholera.....									101,953	.....
Hydronephrosis.....									11	.....
Icterus.....	34		28		1,351		21		2,624	.....
Immaturity.....			2,352		6				25	.....
Injuries, bruises, etc.....	2,988	845	425	72	732	160	20	1	1,086	6,895
Leukemia.....	285		14		13				166	.....
Melanosis.....	10	7	8		10		1		84	.....
Moribund.....	20		3		19		1		74	.....
Necrobacillosis.....	2				34	1				.....
Necrosis.....	3	475		1	5				15	2
Parasitic diseases.....	5	8			17				104	1
Phlebitis.....			327							.....
Pneumonia, pleurisy, enteritis, peritonitis, metritis, etc.....	5,081	12	757	6	5,344	17	55		21,540	628
Pregnancy and recent parturition.....	98				26		1		64	.....
Septicemia, pyemia, uremia.....	1,539		249		694		8		13,184	.....
Sexual odor.....							5		1,938	.....
Skin diseases.....									34	.....
Texas fever.....	904		478							.....
Toxicosis.....	8									.....
Tuberculosis.....	32,644	48,401	440	331	6				66,023	439,915
Tumors and abscesses.....	344	2,578	28	201	67	44	2		1,811	5,744
Total.....	52,496	178,409	5,941	1,750	17,611	298	653	14	213,905	464,217

The following table shows the total condemnations on ante-mortem and post-mortem inspection combined:

*Summary of condemnations.*

Class of animals.	Animals or carcasses.	Parts.
Cattle.....	52,665	178,409
Calves.....	6,380	1,750
Sheep.....	17,650	298
Goats.....	658	14
Swine.....	222,605	464,217
Total.....	299,958	644,688

In addition to the foregoing, the carcasses of animals found dead or in a dying condition were tanked as follows: Cattle, 1,552; calves, 1,200; sheep, 5,442; goats, 64; swine, 88,352; total, 96,610.

The inspection of meat and meat food products prepared and processed under the supervision of bureau employees is shown in the following table. There was an increase of 6.6 per cent over the preceding fiscal year. This is a record of supervisory work performed and not a statement of the actual quantity of products prepared. The same product is sometimes duplicated by being reported in the various stages of preparation and under more than one heading.

*Meat and meat food products prepared and processed under inspection.*

Kind of product.	Pounds.	Kind of product.	Pounds.
Beef placed in cure.....	234,320,254	Neutral lard.....	85,703,981
Pork placed in cure.....	2,913,327,776	Lard oil.....	4,855,913
All other classes placed in cure.....	3,045,311	Lard stearin.....	3,690,052
Sausage, chopped.....	502,674,518	Lard compound.....	7,475,031
Canned beef.....	203,055,782	Lard substitute.....	513,112,454
Canned pork.....	23,796,541	Bakers' compound.....	311,797
All other canned meats.....	5,056,758	Oleo stock and edible tallow.....	62,514,914
Canned beef (second class).....	1,261,471	Oleo oil.....	140,429,986
Canned pork (second class).....	2,789,427	Oleo stearin.....	70,104,224
All other canned meats (second class).....	2,543	Oleomargarin.....	145,931,559
Meat extract.....	850,524	Miscellaneous products.....	1,416,729,445
Steam and kettle rendered lard.....	1,167,476,994	Total.....	7,533,070,002
Leaf lard.....	24,552,747		

The quantity of meat and meat food products condemned on reinspection because of having become sour, tainted, putrid, unclean, rancid, or otherwise unwholesome was as follows: Beef, 7,629,947 pounds; pork, 10,930,149 pounds; mutton, 193,433 pounds; veal, 24,435 pounds; goat meat, 2,158 pounds; total, 18,780,122 pounds.

Market inspection was extended to 2 more cities, making 44 cities at whose public markets Federal meat inspection is conducted in order that interstate deliveries may be made in accordance with the meat-inspection law and regulations.

## MEAT PRODUCTS FOR EXPORT.

For the export of meat and meat food products 87,998 certificates of inspection were issued, covering 409,355,431 pounds of beef and beef products, 976,639,596 pounds of pork and pork products, and 5,185,489 pounds of mutton, a total of 1,391,180,516 pounds. This included 308,920,353 pounds specially prepared with preservatives as allowed by foreign governments. The quantity of products certified for export was an increase of 54 per cent over that of the preceding fiscal year.

There were also issued 1,362 certificates for exports of 18,087,495 pounds of inedible animal products.

## EXEMPTION FROM INSPECTION.

The provisions of the meat-inspection law requiring inspection do not apply to animals slaughtered by farmers on the farm nor to retail butchers and dealers. The department requires that such butchers and dealers, in order to ship meat and meat food products in interstate commerce, shall first obtain certificates of exemption, but no such requirement is made of farmers. The number of certificates of exemption outstanding at the close of the fiscal year was 2,130, an increase of 203 over the preceding year. During the year 134 certificates were canceled on account of the dealers retiring from business or ceasing to make interstate shipments, 34 were canceled for violations of the regulations, and 4 on account of either regular or market inspection being granted, making a total of 172 cancellations. In some cases the certificates were reissued when business was resumed or when the insanitary conditions had been corrected.



During the fiscal year 84,769 shipments were made by retail dealers and butchers holding certificates of exemption, as compared with 114,976 shipments in the fiscal year 1914. The products so shipped were as follows:

*Shipments by retail dealers and butchers under certificates of exemption from inspection.*

Product.	Number.	Pounds.	Product.	Number.	Pounds.
Beef, carcasses (2,084 quarters)	521	231, 821	Cured meats.....		490, 987
Calves, carcasses.....	41, 340	3, 547, 551	Lard.....		44, 375
Sheep, carcasses.....	1, 717	68, 268	Sausage.....		100, 770
Swine, carcasses.....	1, 025	101, 861	Miscellaneous (scrapple, tripe, head cheese, etc.).....		66, 504
Beef, fresh.....		1, 760, 218	Total.....	44, 603	7, 474, 024
Veal, fresh.....		238, 048			
Mutton, fresh.....		523, 271			
Pork, fresh.....		300, 350			

During the fiscal year 78,026 interstate shipments were made of meats and meat food products from animals slaughtered by farmers on the farm, as compared with 87,155 shipments during the fiscal year 1914. The products so shipped were as follows:

*Shipments of farm-slaughtered products under exemption.*

Product.	Number.	Pounds.	Product.	Number.	Pounds.
Beef, carcasses (6,188 quarters)	1, 547	617, 286	Cured meats.....		727, 960
Calves, carcasses.....	107, 426	9, 900, 643	Lard.....		213, 607
Sheep, carcasses.....	8, 986	344, 864	Sausage.....		128, 163
Swine, carcasses.....	17, 068	2, 047, 780	Miscellaneous (scrapple, tripe, head cheese, etc.).....		45, 738
Beef, fresh.....		44, 298	Total.....	135, 027	14, 491, 746
Veal, fresh.....		84, 905			
Mutton, fresh.....		6, 622			
Pork, fresh.....		329, 880			

#### INSPECTION OF IMPORTED MEATS.

Under the provisions of the tariff act of October 3, 1913, inspections of imported meats and meat food products were made by the bureau as shown in the following table. Compared with the nine months of the fiscal year 1914 in which the law was effective, there was a small proportionate decrease in the quantity of products received.

*Import meat and meat food products inspected.*

Country of origin.	Fresh and refrigerated meats.		Cured and canned meats.	Other products.	Total weight.
	Beef.	Other classes.			
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Argentina.....	141, 724, 204	11, 596, 377	1, 849, 376	2, 679, 842	157, 849, 799
Australia.....	7, 856, 818	1, 423, 940	4, 559, 435	42, 313	13, 882, 506
Canada.....	14, 799, 718	11, 813, 133	15, 683, 217	1, 812, 294	44, 108, 362
Uruguay.....	19, 208, 342	1, 234, 137	479, 611	102, 996	21, 025, 086
Other countries.....	5, 026, 471	1, 967, 549	619, 419	544, 245	8, 157, 684
Total.....	188, 615, 553	28, 035, 136	23, 191, 058	5, 181, 690	245, 023, 437

The following statement shows the condemnations of imported meats and the amount refused entry on account of lack of foreign certificate or other failure to comply with the regulations:

*Import meat products condemned or refused entry.*

Product.	Con- demned.	Refused entry.
	<i>Pounds.</i>	<i>Pounds.</i>
Beef.....	1,448,132	25,293
Veal.....	778	594
Mutton.....	424,236	37,477
Pork.....	147,145	7,090
Total.....	2,020,291	70,454

**INSPECTIONS FOR THE ARMY AND THE NAVY.**

At the request of the War and Navy Departments, inspections were made of meat and meat food products offered for the use of the Army and the Navy to determine whether they conformed to the specifications. The meats and products inspected for the Army amounted to 87,982 pounds, all of which conformed to the requirements. For the Navy 12,808,056 pounds was inspected, of which 455,479 pounds was rejected.

**MEAT-INSPECTION LABORATORIES.**

In the general plan to separate the regulatory and research work at the beginning of the fiscal year the seven meat-inspection laboratories were transferred from the Biochemic Division to the Meat Inspection Division.

Samples to the number of 33,021 were analyzed, of which 30,666 were domestic, 1,854 imported, and 501 miscellaneous products. Besides meat and products the samples comprised curing materials, pickling solutions, cereals, spices, condiments, colors, waters, gelatins, inks and ink ingredients, mineral oils for denaturants, inedible greases, process or renovated butter, and paints and lacquers. Of the samples examined, 1,310, or approximately 4 per cent, were found not to conform to the regulations.

The water supply from 304 establishments was examined, and 31 water supplies were found to be polluted and their use in the preparation of meat and products was discontinued.

The objectionable preservative most frequently found was boric acid, and it usually occurred as an impurity in saltpeter and nitrate of soda (Chile saltpeter), and had not been intentionally added to meat food products as a preservative. Most cases of mislabeling were due to short weight and the presence of cereal in meat products, and these were found most frequently in imported products.

**THE FIELD INSPECTION DIVISION.**

The Field Inspection Division, of which Dr. R. A. Ramsay is chief, conducts administrative work for the control and eradication of contagious diseases and the interstate transportation of live stock.

The work of eradicating foot-and-mouth disease has already been reported.

## ERADICATION OF SOUTHERN CATTLE TICKS.

As the result of the work done in cooperation with authorities of various Southern States for the extermination of the ticks which spread the infection of splenetic fever in cattle, areas aggregating 37,255 square miles, as shown by the following table, were released from quarantine during the fiscal year. The total area released since the beginning of this work in 1906 amounts to 253,163 square miles, being a territory greater than the combined areas of Mississippi, Alabama, Georgia, Florida, and South Carolina. The work is also far advanced in a large additional territory.

*Areas released from splenetic fever quarantine as a result of eradicating cattle ticks, fiscal year 1915.*

State.	Square miles.	State.	Square miles.
Alabama.....	1,129	Oklahoma.....	2,385
Arkansas.....	682	South Carolina.....	3,995
California.....	6,007	Texas.....	13,516
Georgia.....	3,216	Virginia.....	193
Louisiana.....	1,197	Total.....	37,255
Mississippi.....	2,063		
North Carolina.....	2,872		

During the year 11,268,668 inspections were made of cattle for ticks, as against 7,276,240 in the preceding year. There were in operation 6,678 cattle-dipping vats where cattle were dipped under Federal or State supervision to rid them of ticks.

In addition to the large number of inspections made and dippings supervised, a great deal of educational and demonstrational work was conducted by bureau employees to teach cattle owners the desirability and importance of eradicating the cattle ticks and to show them the best methods to pursue. This work is done in cooperation with State authorities and is being pushed forward as rapidly as possible with the means at hand. Very effectual cooperation has come from transportation companies, commercial clubs, bankers, and other business men who are far-sighted enough to realize that the eradication of the cattle tick and the subsequent development of the live-stock industry means an increase of business for all interests concerned.

## INTERSTATE TRANSPORTATION OF LIVE STOCK.

The number of cattle shipped from the area quarantined for splenetic or tick fever to market centers outside of the quarantined area was 845,059, as compared with 963,560 during the fiscal year 1914. This was a decrease of 12.29 per cent in the number of tick-infested cattle shipped from the quarantined area for immediate slaughter. There were reshipped from the quarantine pens at market centers to points where southern cattle are permitted to be shipped for immediate slaughter 224,589 head, being a decrease of 31.64 per cent from the preceding year.

The number of cattle of the quarantined area dipped and certified for movement as noninfectious during the year was 147,035, a decrease of 10.99 per cent. Of this number 89,799 were dipped a



second time in order that they might be disposed of for purposes other than immediate slaughter. During the year 1,923 certificates were issued for shipment to markets of free cattle and those dipped or otherwise treated as provided for in the regulations.

There were also dipped, on account of splenetic-fever ticks, 1,106 horses and mules, certificates for the interstate movement of which were issued.

There were inspected at market centers and elsewhere, for scabies and other contagious diseases, 12,634,444 cattle, of which 18,332 were dipped under bureau supervision in order that they might continue in interstate transit.

Sheep to the number of 21,397,574 were inspected at stockyard centers for scabies and other contagious diseases, and 784,849 were dipped under bureau supervision in order that they might be disposed of for purposes other than immediate slaughter.

#### ERADICATION OF SHEEP SCABIES.

The number of inspections of sheep by bureau employees for the eradication of sheep scabies in the area quarantined for that disease was 15,659,624. Sheep to the number of 3,790,967 were dipped for scabies in the quarantined area, in cooperation with the State officials.

As a result of this work sheep scabies is being fast eliminated from the sheep of the Western States. During the fiscal year 9,632 square miles in the State of Utah were released from quarantine.

#### ERADICATION OF CATTLE SCABIES.

The number of inspections of cattle by bureau employees, for the eradication of cattle scabies in the area quarantined for that disease, was 1,264,009, as against 2,812,632 in the preceding fiscal year, being a decrease of 65.72 per cent resulting from the reduction of the quarantined area. In cooperation with State officials, 588,228 cattle were dipped for scabies in the area under quarantine.

The following areas were released from the quarantine for cattle scabies: In Colorado, 37,268 square miles; in Nebraska, 19,714 square miles; in Wyoming, 13,732 square miles; in Texas, 3,486 square miles; total for the year, 74,200 square miles.

#### SCABIES IN HORSES.

The number of horses and mules inspected for scabies during the year was 3,105, of which 2,682 were dipped.

#### GLANDERS IN HORSES.

During the year 837 inspections of horses and mules were made at Indian schools and agencies, and 806 animals were found to be free from glanders, while 31 reacted to the mallein test. This work was done in cooperation with the Office of Indian Affairs of the Department of the Interior.

#### LIP-AND-LEG ULCERATION OF SHEEP.

Inspections for lip-and-leg ulceration of sheep were made at market centers in connection with inspections for other infectious

and contagious diseases of animals, and 3,375 sheep were found to be infected and 2,071 to have been exposed to this disease and were disposed of in accordance with the regulations.

#### INSPECTION AND TUBERCULIN TESTING OF CATTLE FOR INTERSTATE MOVEMENT.

There were inspected by bureau veterinarians, in compliance with the laws of the States to which the animals were destined and upon request of transportation companies or cattle owners, 53,293 cattle moving interstate for purposes other than immediate slaughter, of which number 14,618 were tested with tuberculin. Of the number tested, 328 were found to be diseased with tuberculosis and 7 showed temperatures which required them to be held as suspects for further examination.

#### INSPECTION AND MALLEIN TESTING OF HORSES AND MULES FOR INTERSTATE MOVEMENT.

There were inspected by bureau veterinarians, in compliance with the laws of the State to which the animals were destined and upon request of transportation companies or shippers, 25,392 horses and mules, 7,425 of which were tested with mallein, 26 showing typical reactions to the test and 1 such increase in temperature that it was held for further examination.

#### IMMUNIZATION OF SWINE AGAINST HOG CHOLERA.

Swine to the number of 20,759 were inspected, and under the bureau's supervision were given the immunization treatment against hog cholera, for interstate shipment from public stockyards.

#### VIOLATIONS OF LIVE-STOCK TRANSPORTATION AND QUARANTINE LAWS.

The bureau has continued to report to the Solicitor of the department, for presentation to the Attorney General for prosecution, cases of apparent violation of live-stock transportation and quarantine laws. Many of these cases have required special investigation on the part of bureau employees, such as interviewing witnesses and examining railroad and other records for the completion of evidence. Six bureau employees are regularly assigned to this work, though the greater part of the work of collecting evidence and preparing and submitting reports is done by bureau employees at stockyard centers in connection with their other duties.

#### THE QUARANTINE DIVISION.

The Quarantine Division, under direction of Dr. R. W. Hickman, chief, deals mainly with the importation and exportation of live stock, the management of quarantine stations at the various ports of entry for imported animals, the inspection and disinfection of imported hay, feed, hides, hair, wool, etc., and conducts cooperative work for the elimination of bovine tuberculosis.

#### INSPECTION AND QUARANTINE OF IMPORTED ANIMALS AND PRODUCTS.

During the first half of the fiscal year repeated outbreaks of foot-and-mouth disease occurred in Great Britain, in consequence of which the department suspended the issuance of permits for the importation

of ruminants and swine from the United Kingdom. In the meantime the appearance of this disease in the United States made it inadvisable to permit the importation of such animals at Atlantic seaboard ports. In June, 1915, however, improved conditions in this country, and continued freedom of Great Britain from the disease since December, made it possible to resume the issuance of permits.

Because of the conditions mentioned a comparatively small number of animals were imported during the fiscal year. The importations are shown in the following tables:

*Imported animals inspected and quarantined.*

Port of entry.	Cattle.	Sheep.	Swine.	Other animals.
New York.....	676	7	8	111
Boston.....	135	710	26	.....
Baltimore.....	.....	21	.....	10
San Francisco.....	.....	28	.....	24
Canadian border ports.....	2,759	26	77	4
Total.....	3,570	792	111	149

*Imported animals inspected but not quarantined.*

Port of entry.	Cattle.	Sheep.	Swine.	Horses.	Goats.	Other animals.
New York.....	.....	.....	.....	791	.....	.....
Boston.....	.....	.....	.....	19	.....	.....
Philadelphia.....	.....	.....	.....	6	.....	36
San Francisco.....	.....	88	.....	4	.....	230
Mobile.....	.....	.....	.....	.....	.....	2
Key West.....	.....	.....	.....	1	.....	.....
Mexican border ports.....	353,241	112,627	1,075	13,248	59,808	12
Canadian border ports.....	189,153	40,018	174,128	9,136	11	259
Total.....	544,394	152,733	175,203	23,205	59,819	539

The bureau's inspectors stationed in Great Britain have continued, when requested by prospective importers, to apply the tuberculin test to cattle for shipment to this country. The results of tests made during the year are shown in the following table:

*Results of tuberculin tests in the United Kingdom of cattle for importation into the United States.*

Breed.	Passed.	Failed.	Breed.	Passed.	Failed.
Alderney.....	14	.....	Jersey.....	57	1
Ayrshire.....	11	.....	Shorthorn.....	100	28
Devon.....	19	4	.....	.....	.....
Guernsey.....	406	16	Total.....	611	49
Hereford.....	4	.....	.....	.....	.....

Of the passed animals included in the foregoing table, 3 Ayrshires, 2 Jerseys, and 17 Guernseys were retested on arrival in quarantine in the United States and passed the test; in addition, 23 Guernseys, 4 Herefords, 1 Jersey, and 1 Shorthorn which had not been tested



with tuberculin prior to shipment were tested in quarantine, 28 passing the test and 1 Jersey reacting.

With the object of preventing the introduction of the infection of anthrax or other diseases a close supervision has been continued over importation of hides, horns, bones, glue stock, horse hair, plucked or picked wool, feedstuffs, straw, etc. Special attention has been given to the handling and forwarding of imported merchandise packed in hay or straw and entered at ports in areas quarantined to prevent the spread of foot-and-mouth disease.

#### INSPECTION OF VESSELS AND EXPORT ANIMALS.

The outbreak of foot-and-mouth disease in this country interfered materially with the usual export shipments of ruminants and swine, though shipments of horses to Europe have been heavier than heretofore owing to the great demands of the armies. A smaller number of pure-bred animals have been exported to foreign countries for breeding purposes, and a limited number of cattle have been shipped to France for immediate slaughter. One hundred and fifty-seven inspections of vessels carrying live stock were made before clearance, and 118 certificates of inspection were issued for American cattle, sheep, swine, and horses for shipment to foreign countries.

The following table gives statistics of inspections of live stock for export:

*Inspections of American and Canadian animals for export.*

Kind of animals.	American.		Canadian.	
	Inspections.	Exported.	Inspections.	Exported.
Cattle.....	3,513	3,513	103	103
Sheep.....	988	988	.....	.....
Swine.....	231	231	.....	.....
Horses.....	235	235	12	12
Mules.....	2,536	2,536	.....	.....
Goats.....	24	24	.....	.....
Dogs.....	2	2	.....	.....
Total.....	7,529	7,529	115	115

For shipment to Canada 45,286 horses and 24,294 mules were tested with mallein in accordance with requirements of the Canadian regulations governing the entry of horse stock into that country. Twelve animals reacted to the test and were rejected.

Also, 73 cattle were tested with tuberculin for shipment to Canada, with 1 reaction, and inspections were made of 13,760 sheep and 41 swine.

For shipment to the Hawaiian Islands 49 cattle were tested with tuberculin, with 5 reactions; the mallein test was applied to 75 horses and 625 mules, of which 1 horse reacted; and inspections were made of 104 swine.

One head of cattle and five horses were tested for shipment to other countries than those named.

Department regulations provide that horses may be shipped without bureau inspection and certification, at shipper's risk, to countries

which do not require such inspection and certification as a prerequisite to their admission. During the fiscal year there were shipped to European ports without bureau inspection and certification 253,240 horses and 61,441 mules; there were also shipped to Canada without bureau inspection 7,551 horses.

#### COOPERATIVE TUBERCULOSIS INVESTIGATIONS.

Continued good results have been accomplished in the cooperative work for the suppression of cattle tuberculosis. The cooperation has been conducted with owners of cattle herds in various States, with the dairy and food division of the State of Virginia, the Commissioners of the District of Columbia, and the Office of Indian Affairs of the Department of the Interior.

Progress has also been made in interesting owners of pure-bred herds of cattle in maintaining their herds free from tuberculosis, and a growing interest in this matter is being shown by the State livestock sanitary authorities and by the breed-record associations.

The following statement shows the results of the activities in the District of Columbia, Virginia, and Maryland:

#### *Results of tuberculin testing of dairy cattle in Maryland, Virginia, and the District of Columbia.*

State or District.	Total.	Passed.	Reacted.	Percentage of reactors.
Virginia:				
Original tests.....	3,129	2,600	529	16.91
Annual retests.....	3,048	2,942	106	3.48
Total.....	6,177	5,542	635	10.28
Maryland:				
Original tests.....	223	174	49	21.97
Annual retests.....	477	462	15	3.15
Total.....	700	636	64	9.14
District of Columbia.....	1,078	1,059	19	1.75
Total.....	7,955	7,237	718	9.03

#### ERADICATION OF DOURINE.

During a portion of the year work for the eradication of dourine of horses was conducted in Montana, Nebraska, North Dakota, South Dakota, Wyoming, and on the Navajo Indian Reservation in Arizona and New Mexico. The special appropriation of \$100,000 made by Congress February 23, 1914, having become practically exhausted, and it being necessary to use all available inspectors in the work of eradicating foot-and-mouth disease, the dourine work was almost entirely suspended in October. On March 4 a new appropriation made resumption possible. Notwithstanding these conditions, good progress has been made and the percentage of animals reacting to the test has been lowered. The tests are reported under the heading of the Pathological Division.

**TRANSPORTATION OF HIDES, HAY, ETC., FROM AREAS QUARANTINED FOR FOOT-AND-MOUTH DISEASE.**

In the work of eradicating foot-and-mouth disease the Quarantine Division supervised interstate shipments of hides, skins, wool, hair, horns, hoofs, hay, straw and similar fodder, manure, litter, and bags or similar containers which had been used for stock feed, with a view to preventing the possible spread of the disease through the medium of such articles. Absolute prohibition of the movement of these commodities from quarantined areas would have seriously interfered with many industries. Accordingly, provision was made for their movement under certain clearly defined restrictions, which, while placing the least possible burden upon shippers, appeared to afford the necessary protection. Wherever possible, inspectors were detailed to supervise the disinfection of materials for which such treatment was required as a prerequisite to shipment.

**THE PATHOLOGICAL DIVISION.**

The work of the Pathological Division, which comprises the scientific investigation of animal diseases, was under the direction of Dr. A. R. Ward, chief, during the fiscal year.

The outbreak of foot-and-mouth disease in the fall of 1914 claimed the services of a large number of the scientific force of this division for several months.

**DOURINE INVESTIGATIONS.**

The complement-fixation test has continued to be extensively employed for the diagnosis of dourine, 52,896 samples of blood having been received and diagnosed by this method, of which 1,515, or 2.7 per cent, gave positive reactions. This shows a marked decrease from the preceding year, when 2,550 out of 51,293 samples, or 4.9 per cent, reacted positively. Comparatively few positive reactions have been obtained with samples received from sections of the country covered during the preceding year where dourine was found to be very prevalent, a feature which even more convincingly than the reduced percentage illustrates the possibilities of the test as a means of ultimately eradicating this affection.

Various changes have been made in the technique of the test and new apparatus has been devised that facilitates the work to some extent, as a result of which but little delay has been necessary in diagnosing the specimens of blood sera, even though they were received on some days in enormous numbers.

**GLANDERS.**

The complement-fixation test was applied to serum from the blood of 1,306 horses suspected of being affected with glanders, of which 196, or 15 per cent, gave positive reactions.

**CEREBROSPINAL MENINGITIS OR FORAGE POISONING.**

Cerebrospinal meningitis or forage poisoning occurred in the Central Western States during the fall and winter months and occasioned the death of many horses. Milder outbreaks of the disease occurred in New Jersey and Maryland in the early fall.



The disease in Maryland lasted throughout the month of August, and a study was made of it and the attendant conditions. The feed of the animals in all cases but one consisted of native hay, bran, corn stover, and immature corn affected with weevils. The corn stover and a great part of the corn were badly contaminated by molds. Most of the animals were allowed to graze a little, and in the exception noted above the animals (Chincoteague ponies) obtained all their subsistence by grazing.

Blood drawn aseptically from a case in the early stages of the disease and from another case in a very late stage proved by culture media inoculations to be sterile. Fresh defibrinated blood from these two horses injected intravenously into other horses in doses of 30 c. c. at the Bethesda experiment station did not engender any symptoms of disease. Corn chaff and bran from local millers and corn and corn stover from the various farms where the disease occurred were fed to horses at the experiment station, but did not cause any symptoms of the disease.

#### EXPERIMENTS ON ANTHRAX VACCINATION.

The Pasteur treatment, which has been almost exclusively employed in this country for vaccination against anthrax, while effective in cases where the vaccine is of a desired potency, has its disadvantages in that this product deteriorates at times very rapidly under normal conditions, as, for instance, when it is exposed to light and high temperature. Samples have been examined from time to time by this bureau, with the result that vaccine purchased in the South was at times found to have become inert in from two to three months from the time of manufacture. The use of such vaccine would, of course, impart a false security to the owners, and subsequent outbreaks would tend to bring this method of prevention into disrepute.

Experiments have been conducted on the preparation of immune serum to be used in connection with the spore vaccine for the immunization of animals against anthrax. Horses were employed for the preparation of the serum, and after several months of treatment with increasing doses of anthrax culture the serum attained a very high potency for immunizing purposes. The serum is injected simultaneously with the spore vaccine, and this gives the method an additional advantage over that of Pasteur, since only one handling of the animal is necessary instead of two as with the latter method.

The experiments on both small and large animals proved the effectiveness of this method of vaccination beyond a doubt. An opportunity was also afforded to test it out in actual outbreaks of anthrax. One of these outbreaks occurred in Mississippi, where a considerable number of animals have been lost from anthrax. Following the immunization not a single death resulted. Similar results were obtained in an outbreak of anthrax among hogs in Maryland, where the disease was effectively checked by the administration of immune serum. An outbreak on the Eastern Shore of Maryland gave still another opportunity of testing the potency of simultaneous vaccination, with equally good results.

A noteworthy feature in connection with the immunization value of this method is the curative value of the serum. This has been repeatedly tested on animals affected with anthrax in these various outbreaks, and astonishing results were obtained. Animals with a temperature of from 105° to 107° F. recovered after the injection of the serum in doses of from 50 to 150 c. c.

Further experiments are being conducted with a view to concentrating the serum and preparing it and the vaccine in convenient form and at the same time preventing deterioration and contamination, also with a view to establishing the variations of the agglutination and precipitation values of the serum in the course of the hyperimmunization of horses. Complement fixation is also being employed in connection with these experiments.

#### INFECTIOUS ABORTION OF CATTLE.

Four hundred and thirty-eight samples of serum from cattle were tested for infectious abortion by the application of the agglutination test, and 222 of these were also tested by means of the complement-fixation method, with essentially the same results in practically all cases. Much of this duplicate testing has been done in cooperation with the New York State experiment station, incidental to research in connection with the disease.

An ever-increasing number of inquiries concerning abortion in range cattle have been received, indicating the spread of the disease to the beef breeds. Much literature has been distributed in response to letters of inquiry.

Considerable research has been made in the abattoirs of New York and New Jersey in relation to the prevalence of granular venereal disease or infectious vaginitis of cattle by means of which it was found that venereal nodules or granules are just as common in the genital organs of the male as of the female. These lesions were also found in the genital organs of sheep and goats of both sexes.

#### IMMATURE AND HAIRLESS PIGS AND "BIGNECK" IN CALVES.

Immature and hairless pigs and "bigneck" in calves have been increasingly prevalent in the States of the Northwest. The diseases are found in the bottom lands of the chief river systems, more especially the Columbia, Missouri, and Yellowstone. Officials of the Montana experiment station report that over 500,000 pigs have been lost during the past year within their State alone. They state that this condition constitutes the greatest menace to the live-stock interests of the State, and furnishes the most serious problem which the State agricultural department has to meet. They have urgently requested the cooperation of the bureau in overcoming the outbreak.

Nineteen samples of serum from sows farrowing hairless pigs have been tested for contagious abortion with negative results, except in one case, which is being investigated further. A hairless pig received from Montana was cut up and fed to a pregnant sow about one month before she was due to farrow. The sow gave birth to six healthy pigs. Other pigs were sent, but arrived during hot weather and decomposition prevented their utilization.

A man was sent to investigate an outbreak of the so-called "big-neck" of calves, which was reported by the Forest Service as being prevalent in the Methow Valley, in northern Washington. The investigator arrived too late to find suitable material, as the calving was largely over for the season.

#### SWAMP FEVER OR INFECTIOUS ANEMIA OF HORSES.

Experiments in the diagnosis of swamp fever have been continued, particular attention having been given to the procuring of an antigen that will permit the diagnosis of suspected cases by means of laboratory procedures, though no satisfactory method has yet been discovered. A special structure has been erected for use in investigations relative to transmission by insects. Exposure tests have been made with *Tabanidæ* flies, but no transfer of swamp fever from horse to horse has yet occurred through this means.

The experiments of Seyderhelm and Seyderhelm for determining the poisonous properties of cestrin, an extract from bots, have been repeated, in view of the conclusion of those investigators that swamp fever is due to bots. In none of the experimental cases of the bureau, however, have bots played any part whatever. An extract was made by grinding bots in sterile saline solution and filtering, and this filtrate was tested on washed-blood corpuscles to determine whether it might contain some form of hemolysin. The experiment gave negative results. Donkeys injected with the extract prepared from the bodies of bots showed no harmful effects aside from slight temporary uneasiness.

#### EXAMINING CATTLE REACTING TO THE TUBERCULIN TEST.

The examination of glands and other tissues from cattle that have reacted to the tuberculin test but in which no visible lesions of tuberculosis could be discovered at time of autopsy, has been continued. Specimens from 42 reacting cattle of this class were examined by laboratory methods for the presence of tubercle bacilli, and tubercle bacilli were found in 15. This proportion is much lower than usual.

#### WHITE SCOURS IN CALVES.

The relationship between white scours and pneumonia of calves, the tendency of the blood from affected calves to react to the agglutination and complement-fixation tests, and the possible relationship between the two diseases mentioned and abortion of cattle have been given extensive study, but no conclusion has been reached. Many inquiries have been received concerning white scours in calves, and each has been answered with directions for improving the sanitary surroundings of the stables in which the stock was kept.

#### RABIES.

Because of the necessity of confining examinations for rabies to animals in the immediate vicinity of Washington, a smaller number than usual of suspected cases were received. Eighty animals were submitted for laboratory diagnosis, and of these the diagnosis was positive for 36 dogs, 2 cows, 2 cats and 1 hog, a total of 41 positive cases.



## BLACKLEG VACCINE.

During the fiscal year 3,454,628 doses of blackleg vaccine were distributed to stock raisers and farmers. This is approximately 45 per cent more than was distributed during the fiscal year 1914. This increase, however, does not indicate that the disease is on the increase, but rather that stockmen in blackleg districts who have not previously vaccinated their animals are recognizing the practicability and value of vaccination.

## INVESTIGATION OF POULTRY DISEASES.

During the year a large number of diseased domesticated birds or their carcasses were received from various States for examination in the pathological laboratory, and an increased volume of correspondence asking for advice and information relative to poultry diseases was received.

The apparent increase in the spread of bacillary white diarrhea of young chicks caused a line of research to be started for the purpose of developing biologic agents to combat its ravages. Research work was also begun on the problem of developing a method for immunizing fowls against fowl cholera.

Special investigations to determine the therapeutic value of proprietary medicines were conducted in cooperation with the Bureau of Chemistry under the food and drugs act.

Some tests were made to determine the possibility of using products elaborated by *Bacterium pullorum* in culture to detect infection caused by that organism in fowls, in a manner similar to the intradermal tuberculin test. The test was applied to fowls artificially infected with *Bacterium pullorum* and to healthy control birds. The results were to some extent discordant, but were such as to warrant continuing the work.

## FOWL TICKS AND SPIROCHETOSIS.

In many countries the fowl tick *Argas miniatus*, besides being a serious parasite of fowls, transmits the blood parasite *Spirochæta gallinarum*, which causes a disease of fowls known as spirochetosis. The presence of fowl ticks in the United States, in southern and western Texas and in a belt of territory along the southern and western border to a point north of San Francisco, Cal., raised the question of the existence of spirochetosis among fowls in that region. Twenty-four lots of ticks were subjected to examination and used in various ways in the attempt to induce spirochetosis in young chickens bred in the vicinity of Washington. In no case was disease produced. Microscopic examination of the blood of fowls gave negative results. The work is being continued with ticks and fowls from flocks where there is definite suspicion of the existence of spirochetosis.

## COOPERATIVE WORK ON POULTRY DISEASES IN CALIFORNIA.

Cooperative work has been conducted with the University of California in the investigation of poultry diseases. The main problem under investigation has been the clearing up of the confusion regard-

ing the number and identity of the diseases of fowls embraced in the group commonly designated as common colds, catarrh, roup, diphtheria, and chicken pox. The plan of the work included particularly measures aimed at the differentiation of avian diphtheria from chicken pox; immunity tests for differentiation of diseases; tests of methods of transmission; tests of infectivity of diseases to various species, and possible application of the complement-fixation method and the microscopic examination of tissues. Considerable data on the use of a vaccine for curative and preventive use in chicken pox have been collected.

As outbreaks of other poultry diseases came to notice under conditions favorable for research, observations were made upon them. Opportunity has been afforded for work upon coccidiosis and enterohepatitis. An outbreak of bacillary white diarrhea was studied with particular reference to the agglutination method of diagnosis. The conditions surrounding an extensive mortality of ducks were studied, as well as the pathology and bacteriology of the affection.

The diagnosis of material sent in by poultrymen has included cases of roup, bacillary white diarrhea, enterohepatitis, chicken pox, coccidiosis, and fowl cholera.

#### PHYSIOLOGICAL INVESTIGATIONS.

The work on immature veal was brought to a close and the experimental data prepared for publication. The study of the comparative chemical composition of mature beef and immature veal disclosed no differences that were physiologically significant. In a large number of artificial digestion experiments the veal was digested as rapidly as beef. Feeding experiments on cats gave no indication of harmfulness of immature veal.

A number of experiments were made on internal disinfection. Cows were fed urotropin by mouth, hydrochloric acid was injected intravenously, and the milk was then tested for formaldehyde. Definite results have not yet been obtained.

#### CONTROL OF BIOLOGICAL PRODUCTS.

The control of the preparation of biological products, with the exception of anti-hog-cholera serum, hog-cholera virus, mallein, and tuberculin, has been continued under the supervision of the Pathological Division. Samples of immune sera, vaccines, and bacterins were procured from time to time in the open market and subjected to bacteriological and potency tests. In several instances the product failed to meet the legal requirements and the manufacturers were notified of the deficiency. It is gratifying, however, that the examination of biological products only very exceptionally proved them worthless or contaminated, and it is apparent that the manufacturers are endeavoring to meet the requirements of the department by producing pure and efficient products. Further work on this subject is reported under the heading of the Biochemic Division.

#### TOXICITY OF DISINFECTANTS.

The testing of various disinfectants offered for sale to the public has been continued in conjunction with the insecticide and fungicide board. A number of autopsies were held, and in some instances histological sectioning of affected tissues has been necessary.

## BRANCH PATHOLOGICAL LABORATORIES.

The branch pathological laboratory at Chicago has done special work to determine the nature of a certain acid-fast bacillus which was found in the skin, subcutaneous tissues, and lymph nodes of swine. This work is still in progress. Work has also been started to determine the etiology and nature of a softening of bones in cattle. At the present time no definite conclusions have been reached in regard to this condition.

One hundred and seventy-five specimens were received during the year at the South Omaha branch laboratory. These represented the usual routine conditions calling for the aid of the microscope in diagnosis.

## TESTS OF ABNORMAL MILK.

The results of investigations made at the Philadelphia laboratory show that the alizarol test as applied to market milk can not be depended upon alone to reveal the presence of abnormalities. Many samples were examined which did not react to the alizarol test, yet were found to be defective by one or more of the other methods. On the other hand, most of the samples found to be defective by the alizarol test were also detected by one of the other tests. No relation was found to exist between the alizarol test and the catalase test in the examination of market milk.

## THE BIOCHEMIC DIVISION.

Dr. M. Dorset has continued in charge of the Biochemic Division.

## RESEARCH WORK ON MEAT INSPECTION.

Under an order of the Secretary of Agriculture directing a segregation, so far as possible, of the regulatory work on the one hand and of the research work on the other, the routine laboratory work relating to meat inspection was transferred to the Meat Inspection Division July 1, 1914. The Biochemic Division has continued to carry out research work relating to meat inspection.

## INVESTIGATIONS CONCERNING COLD STORAGE OF MEATS.

A study of the changes taking place in fresh beef stored at temperatures above freezing was completed during the fiscal year, and the data are being checked and tabulated. In this investigation hind quarters of beef were stored at temperatures ranging from 32° to 36° F. for periods varying from 14 to 180 days. At the beginning and at the end of each storage period chemical, bacteriological, histological, and organoleptic examinations were made of each sample. The conclusions can only be formulated after all data have been tabulated and studied.

It has been generally recognized that natural autolysis probably plays an important part in the changes taking place in meats during cold storage, but experimental evidence on this point has been lacking. A series of experiments was therefore conducted to determine the nature and extent of changes which may be brought about in lean muscular tissue of meats by enzymes occurring naturally in the tissues. These experiments have indicated, among other things, that



under aseptic conditions during cold storage there is a marked change of the creatin of meats to creatinin.

Studies on the bacteriology of meats in cold storage were carried out in close cooperation with the chemists working on the cold-storage problem. While this work is not fully completed, the following conclusions seem warranted: (1) Certain bacteria, chiefly micrococci, may be normally present in the carcasses of healthy animals; (2) these bacteria do not appear to multiply in carcasses stored at temperatures above freezing ( $32^{\circ}$  to  $36^{\circ}$  F.); (3) the bacteria found in normal carcasses are of no pathological significance; (4) bacteria and molds grow on the surface of cold-stored carcasses but do not penetrate to any great depth (less than 1 inch).

#### INVESTIGATIONS OF SOFT OR "MUSHY" HAMS.

The investigation to determine the cause of the soft or mushy condition at times found in hams has been continued. Additional examinations have shown that while *Sarcocystis miescheriana* was present in a considerable proportion (57 per cent) of the soft hams examined, infestation with this parasite can not be regarded as the cause of the soft condition of the muscle fibers, because in certain typical examples of such hams the parasite was absent. Microscopic sections have, however, revealed the presence of bacteria, and at times yeast cells, in the softened portions of the ham. Putrefactive bacteria and micrococci were almost constantly present in great numbers in the soft portions, and apparently extended into the firmer portions of the hams. The conclusion seems justified that the soft or mushy condition is due to the action of bacteria, which causes a disintegration of the tissue cells, this being later accentuated by cooking. This subject will be given further study.

#### DENATURING AGENTS FOR FATS.

Particular attention has been devoted to a study of mineral oils as denaturants for fats. This required a study of the physical and chemical properties of the denaturant, of the possibility of its removal from fats, and its effect on fats, both with regard to changes produced in the taste, odor, and color and to the use of the denatured fats for commercial purposes, as in soap making and the production of lubricants.

As a result of these investigations it was found that mineral oil, such as gas oil, power distillate, or an equivalent having a boiling point not less than  $205^{\circ}$  C., a flash point (open cup) not lower than  $75^{\circ}$  C., a specific gravity not lower than  $42^{\circ}$  B., and which may be easily recognized by taste when present in the proportion of 1 part of oil to 1,000 parts of fat, constituted a satisfactory denaturing agent. The use of such oil has been permitted by the bureau as a denaturing agent when added to carcasses and parts during the process of rendering, or to fats which are rerendered, provided the quantity of the denaturant is sufficient to make 1 part of the denaturant in each 200 parts of anticipated yield of rendered grease.

#### MISCELLANEOUS INVESTIGATIONS.

Some work has been carried on concerning the composition of meat extracts derived from various parts of the carcass; the study of the changes which occur in canned meats after prolonged keeping has

been continued, and a number of bacteriological examinations of samples of meat and canned goods have been made from time to time for the Meat Inspection Division to determine the possible presence of bacteria which might be harmful to human health.

The preparation of branding ink for marking inspected meats has been continued, 2,475 gallons of this ink having been prepared during the year at a cost of \$1,127.25 for materials and containers.

#### DIPS AND DISINFECTANTS.

The laboratory of dips and disinfectants has received during the year 395 samples for examination. These consisted of samples of arsenical dips, nicotin solutions, lime-sulphur solutions, and a considerable variety of disinfectants.

#### TESTING AND ANALYSIS OF DIPPING BATHS.

The demand from bureau inspectors for field outfits for testing dipping baths has greatly increased and the preparation and shipment of such outfits has become an important part of the work of this laboratory. During the calendar year 1914 the following supplies of this character were sent out: One hundred and thirty new test outfits for arsenic, in addition to 122 already sent out, making a total of 252 in the field on January 1, 1915; supplies for making arsenical tests in 1914, a sufficient quantity of the necessary materials properly apportioned to make 32,000 tests; 58 new test outfits for lime-sulphur dips, in addition to 3 previously sent out, making a total of 61 in the field on January 1, 1915; supplies for testing lime-sulphur dips, a sufficient quantity to make approximately 6,400 tests. During the year a field test for nicotin baths has been adopted for official use, and supplies for this test are now being sent out.

The studies of the changes in degree of oxidation of arsenic in dipping baths in actual use in the field, which were continued from last year, have been compiled and published as Department Bulletin 259. To conclusions previously reported it may be added that formaldehyde has been found to be effective in holding oxidation of dipping baths down to a low figure, but it is believed that in most cases it may be cheaper to let some of the arsenic go to waste through oxidation rather than to use formaldehyde as a preservative.

Some new methods for the analysis of lime-sulphur solutions and dipping baths have been developed, with the object of obtaining more exact quantitative knowledge of the precise combinations of sulphur and of lime which exist in lime-sulphur dipping baths.

Investigations have been made of the effect of the continued use of hog-dipping baths under field conditions. The results show that progressive loss of cresol follows such use and that serious diminution of strength may be the final result. The desirability of a field test for cresol dips is clearly indicated. A method for the field testing of cresol dips has been devised and is now being subjected to field test.

#### DISINFECTING HIDES.

A bacteriological study of methods for disinfecting hides against anthrax was continued and completed. The conclusions arrived at were briefly as follows:

The Seymour-Jones method of disinfecting with mercuric chlorid and formic acid was found to be inefficient when the proportions of

these agents recommended by Seymour-Jones were employed. By increasing the strength of mercuric chlorid to 1 part in 2,500 and using this with 1 per cent of formic acid it was found possible to destroy anthrax spores upon pieces of hide even when the disinfectant was subsequently neutralized by sodium sulphid or some other agent, provided that an interval of at least a week was allowed between the use of the disinfectant and the application of the neutralizing agent.

The Schattenfroh method of disinfection, which consists in using a 2 per cent solution of hydrochloric acid with the addition of 10 per cent of sodium chlorid, with an exposure of 48 hours, was found to be entirely satisfactory from a bacteriological standpoint.

Examination of small pieces of disinfected hide by the leather and paper laboratory of the Bureau of Chemistry indicated that neither the Seymour-Jones nor the Schattenfroh method exerts any injurious effect upon hides or leather.

#### OTHER WORK ON DISINFECTANTS.

The laboratories have cooperated with other laboratories, including those of the United States Public Health Service, in a study of methods for the standardization of disinfectants. This work is not yet completed.

The bureau has continued to assist in the enforcement of the insecticide act of 1910. The assistant chief of the Biochemic Division has devoted a large part of his time during the year to this work, carrying on an extensive correspondence concerning features relating particularly to the animal industry, and serving as a member of the Insecticide and Fungicide Board. In the laboratories of the Bureau of Animal Industry there were received during the year 210 samples of insecticides and fungicides for examination.

#### TUBERCULIN AND MALLEIN.

During the fiscal year 455,702 doses of tuberculin were sent out to State, county, and city officials, to be used in testing cattle for tuberculosis. Mallein to the extent of 368,530 doses for testing horses and mules for glanders, was likewise furnished.

#### HOG-CHOLERA WORK.

Field experiments, demonstrations, and educational work in the prevention and eradication of hog cholera were carried out in accordance with the plan outlined in some detail in the preceding annual report. The work was divided into three major classes, as follows: (a) County control investigations, being experiments designed to determine the practicability of eradicating hog cholera from selected sections of the country; (b) demonstrational and educational work, the object being to determine the feasibility of enlisting the aid of the farmers themselves in efforts to combat hog cholera; (c) enforcement of the virus-serum-toxin act of 1913—regulatory work almost entirely.

#### COUNTY CONTROL INVESTIGATIONS.

The county control work was begun in 1913 with 3 counties, and was extended until in 1914 it included 17 counties in different portions of the country. The outbreak of foot-and-mouth disease in



the fall of 1914 interfered with this work to some extent and made it necessary to drop two of the counties in which the work had been established. Leaving those two counties out of consideration, the work has been conducted in the following counties: Decatur County, Ga.; Twin Falls County, Idaho; Hendricks and Montgomery Counties, Ind.; Clay and Dallas Counties, Iowa; Marshall County, Kans.; Henderson County, Ky.; Branch County, Mich.; Renville County, Minn.; Pettis County, Mo.; Gage and Johnson Counties, Nebr.; Muskogee County, Okla.; Davison County, S. Dak.; Maury County, Tenn.

At each of these stations the work is conducted by one veterinary inspector in charge, with two assistant veterinarians and one clerk. The total force employed in the field was approximately 60 men. The serum used was prepared at the department's serum plant at Ames, Iowa, and was applied in the selected areas by department inspectors free of charge to farmers.

The methods employed in these counties have been purposely varied, as the problems to be met have been found to be different in different localities. In some counties all of the inoculation work has been done with the serum alone. In other counties the simultaneous method (serum and virus) has been used in conjunction with the serum alone. In these latter counties in an infected herd the apparently infected hogs were given the serum alone, whereas the hogs which appeared well at the time of treatment were given the simultaneous inoculation.

The bureau's men have had the cooperation of State authorities. The State college in many cases has undertaken to make a survey of the area, collect statistics, and assist in general educational work in the county. The State veterinarian or the State live-stock sanitary board has undertaken the duty of enforcing the necessary quarantine and sanitary measures and supervising the disinfection of infected premises.

These county experiments are not intended primarily to demonstrate how to eradicate or control hog cholera, but they are rather a series of experiments on a large scale to ascertain the best and most practicable methods for the control of hog cholera.

Some of the results up to the end of the calendar year 1914 follow.

The first table shows the results following the treatment of herds which were apparently well when treated, but which were regarded by the field inspectors as exposed. They were usually hogs on farms in the immediate vicinity of an infected herd. In the exposed herds the losses following the serum-alone and simultaneous methods are insignificant in both cases. The slight difference in favor of the latter is too small to be regarded as indicating the superiority of either method over the other.

*Results of serum treatment in exposed herds of hogs apparently well when treated, 1913-14.*

Mode of treatment.	Number treated.	Number lost.	Per cent lost.
Serum alone.....	9,686	34	0.35
Simultaneous.....	8,010	14	0.17
Total.....	17,696	48	0.27

The next table shows the results in herds which were affected with hog cholera at the time of treatment.

*Results of serum treatment of herds affected with hog cholera, 1913-14.*

Condition of hogs and kind of treatment.	Number treated.	Number died.	Per cent died.
Hogs sick when treated—serum alone.....	53,485	15,570	29.1
Hogs apparently well when treated:			
Simultaneous.....	44,277	1,298	2.9
Serum alone.....	49,462	2,077	5.1
	84,739	3,375	4.0
Total.....	138,224	18,945	13.7

Although approximately 38 per cent of the hogs were sick when treated, the sickness being indicated either by the physical appearance of the hog or by its temperature, only 13.7 per cent died. This indicates clearly that the serum has a distinct curative action when administered in the early stages of the disease.

Observations of the effect of inoculation upon pregnant sows are presented in the following table:

*Results of treatment of pregnant sows, 1914.*

Condition of herds.	Mode of treatment.	Number of sows.	Number aborted.	Per cent aborted.
Infected.....	Serum alone.....	981	126	12.8
Do.....	Simultaneous.....	388	37	9.5
Exposed.....	Serum alone.....	96	2	2.1
Do.....	Simultaneous.....	28	.....	.....

It is fair to assume that the higher percentage of abortions among sows treated with serum alone is attributable to the fact that some of these sows were affected with hog cholera when treated, whereas, although some of those given the simultaneous method may also have been infected, it is probable that the proportion was less. These figures indicate that the simultaneous method does not produce abortion in pregnant sows.

Extensive observations and comparisons of treated and untreated sows in Dallas County, Iowa, in 1913 and 1914 lead to the conclusion that the simultaneous method, when properly applied, does not produce sterility in sows. Out of 1,746 sows in 126 herds treated by the simultaneous method, 98, or 5.62 per cent, proved sterile, while 74 untreated sows out of 1,103 in 87 herds, or 6 per cent, were sterile.

The next table summarizes the sources of infection as reported by field inspectors. The sources of infection have been arranged in three groups. The first includes near-by sources; the second, distant sources; and the third, indefinite or indeterminate sources. The sources of infection were of course not determined with absolute certainty, as that would be impossible; but inspectors in the field were instructed to make careful inquiries at each infected farm, and the results here reported are a summary of their conclusions. Approximately 58 per cent of the outbreaks appear to have come from near-by sources, 23 per cent from distant sources, and 19 per cent are reported as indefinite.

*Sources of infection and ways in which hog cholera may reach the herd, 16 counties, 1914.*

Supposed source of infection.	Herds.	Per cent.
From near-by sources:		
Exchanging labor and visiting infected premises.....	645	23.10
Exposure of sick hogs on adjoining farms.....	235	8.42
Harbored infection.....	463	16.59
Dogs.....	267	9.57
Per cent from near-by sources.....		57.69
From distant sources:		
Infected cars and public highways.....	33	1.18
Purchase of new stock.....	95	3.40
Contaminated streams.....	45	1.61
Birds.....	482	17.27
Per cent from distant sources.....		23.46
Indefinite.....	526	18.85
Total.....	2,791	

Experimental work has shown that hogs treated by the serum alone may remain immune from three weeks to three months, and that the simultaneous method produces an immunity which appears to last in most cases for life. The following table gives the results of observations made in all of the 16 counties in which the work was conducted in 1914. In several of these counties the work did not begin until midsummer, and in some of them not until September and October, so that in some cases the lapse of time has not been sufficient for the immunity to run out:

*Recrudescence of hog cholera in treated herds, 16 counties, 1914.*

Mode of treatment.	Number of herds treated.	Number of cases of recrudescence.	Per cent of recrudescence.
Simultaneous and serum-alone combined.....	1,154	15	1.30
Serum-alone exclusively.....	1,605	89	5.55
Total.....	2,759	104	3.77

The next table gives the results in the three counties in which work was begun in 1913, and in which the observations have extended over the entire year 1914:

*Recrudescence of hog cholera in treated herds, three counties, 1914.*

Counties.	Simultaneous and serum-alone combined.			Serum-alone exclusively.		
	Number of herds treated.	Number of cases.	Per cent.	Number of herds treated.	Number of cases.	Per cent.
Montgomery, Ind.....	268	1	0.4	155	.....	.....
Dallas, Iowa.....	174	3	1.7	132	1	3.1
Pettis, Mo.....	.....	.....	.....	321	43	13.4

<sup>1</sup> These herds were treated between Nov. 1 and Jan. 1, therefore in most cases sufficient time for reinfection had not elapsed when this summary was prepared.



A study of the number of outbreaks reported in Dallas County, Iowa, Montgomery County, Ind., and Pettis County, Mo., by months, shows that in these three counties hog cholera was vastly more prevalent in the fall than at any other season of the year. It is recognized, however, that the season of greatest prevalence may vary in widely separated sections of the country.

The following table gives comparative statistics of hogs raised and hogs that died of hog cholera in 16 counties during the years 1912, 1913, and 1914, and shows a marked decline in the death rate from hog cholera as the experimental work progressed. The entire 16 counties lost 134,820 fewer hogs in 1914 than in 1913. Particular attention is directed to Montgomery County, Ind., Dallas County, Iowa, and Pettis County, Mo., where the work has been in progress longest and in which the increase in the number of hogs raised and the decrease in the number that died are especially significant.

*Statistics of hogs raised and hogs that died of hog cholera in 16 experimental counties, 1912 to 1914.*

County.	Date work begun.	1912			1913		
		Hogs raised.	Number that died.	Died per 1,000.	Hogs raised.	Number that died.	Died per 1,000.
Decatur, Ga.	Aug. 25, 1914	48,418	8,546	176	52,797	12,225	231
Twin Falls, Idaho.	July 6, 1914	47,673	3,163	66	82,563	12,978	157
Kankakee, Ill.	June 20, 1914	46,835	9,000	213	41,700	7,000	167
Hendricks, Ind.	Sept. 3, 1914	63,259	13,532	204	72,211	12,908	178
Montgomery, Ind.	July 5, 1913	77,403	24,404	315	78,813	5,136	64
Clay, Iowa.	July 10, 1914	73,065	25,000	342	87,953	30,266	344
Dallas, Iowa.	July 1, 1913	84,618	19,821	234	118,550	12,000	101
Marshall, Kans.	July 6, 1914	65,294	3,853	59	72,036	7,230	100
Henderson, Ky.	July 22, 1914	35,814	8,743	244	30,866	3,934	127
Branch, Mich.	May 28, 1914	46,170	1,209	25	55,338	4,039	72
Renville, Minn.	May 8, 1914	65,790	8,998	136	85,699	43,403	564
Pettis, Mo.	Aug. 1, 1913	59,661	18,853	316	107,151	6,386	59
Gage and Jason, Nebr.	Mar. 31, 1914	76,591	5,445	70	80,949	6,012	74
Allen, Ohio.	June 24, 1914	68,655	10,470	152	80,719	11,355	141
Davison, S. Dak.	Oct. 6, 1914	39,920	2,270	56	57,695	16,248	281
Maury, Tenn.	July 21, 1914	73,234	8,399	114	69,787	6,360	91
Total.		975,400	171,706	178	1,175,827	197,510	168

County.	Date work begun.	1914		
		Hogs raised.	Number that died.	Died per 1,000.
Decatur, Ga.	Aug. 25, 1914	55,000	11,618	211
Twin Falls, Idaho.	July 6, 1914	100,000	1,269	12
Kankakee, Ill.	June 20, 1914	30,500	1,800	59
Hendricks, Ind.	Sept. 3, 1914	85,955	4,065	42
Montgomery, Ind.	July 5, 1913	85,119	2,296	26
Clay, Iowa.	July 10, 1914	89,874	4,209	46
Dallas, Iowa.	July 1, 1913	138,320	6,810	49
Marshall, Kans.	July 6, 1914	65,592	3,432	52
Henderson, Ky.	July 22, 1914	20,000	2,907	145
Branch, Mich.	May 28, 1914	57,878	715	12
Renville, Minn.	May 8, 1914	100,722	5,069	50
Pettis, Mo.	Aug. 1, 1913	136,030	5,847	42
Gage and Jason, Nebr.	Mar. 31, 1914	71,059	3,541	49
Allen, Ohio.	June 24, 1914	105,000	1,027	9
Davison, S. Dak.	Oct. 6, 1914	45,430	4,891	107
Maury, Tenn.	July 21, 1914	70,250	3,194	45
Total.		1,256,729	62,690	49

## CONCLUSIONS FROM EXPERIMENTS.

The results of the experiments indicate clearly that by pursuing one or the other of the systems followed the losses from hog cholera can be reduced to a minimum and the industry of hog raising greatly increased in a given area. The progress of the work and the reports of field inspectors, however, lead to the belief that at the present time such marked success in reducing losses from hog cholera as is reported can not be expected with a smaller number of inspectors or with a less amount of work in each county. Success could be attained only through the employment of an immense force of men and the expenditure of enormous sums of money. The eradication or the control of hog cholera is not merely a question for the Federal Government, because the Government can not succeed without full and adequate cooperation on the part of State governments and farmers themselves. It seems that at the present time a country-wide campaign for the eradication of hog cholera would be ill-advised. Before an active campaign for control and eradication is begun the various States should have more effective laws governing diseases of live stock and more extensive organizations for enforcing such laws.

There is need for the further training of the farmers by experienced men in methods of preventing the spread of disease, so as to induce a greater willingness on the part of the farmer to do his part and to make individual sacrifice for the benefit of the community.

Although some States are now in a fairly good position in these respects, it seems that if they should work alone without simultaneous effort on the part of all other States they would be constantly exposed to the menace of reinfection and to the discouragement of having their labor go for naught because of infection brought from other States. Until the country is prepared to undertake a real campaign for eradication or permanent control the function of the Federal Government should be for the present largely advisory, assisting the States to form stable organizations among farmers, and to secure proper distribution and administration of potent anti-hog-cholera serum, so that the greatest amount of good may be accomplished in the way of saving infected herds.

It seems that the eradication of hog cholera from the United States, if it can ever be accomplished, must be a work of many years, and no one plan can now be suggested which gives reasonable promise of success. In the meantime farmers should have explained to them through lectures, demonstrations, and literature the nature of hog cholera, the ways in which it is spread, and the best methods of combating it. The anti-hog-cholera serum should be made more readily available. This might be done through the establishment of serum stations or depots in each county in the State, to be maintained by the State or the county. Each farmer of the State should be acquainted with the location of the nearest serum depot and be allowed to obtain serum at the lowest cost for good serum. With one man to represent the State or Federal Government in each county, and to act in a general supervisory capacity over the distribution of the serum and its use, a great amount of good might be accomplished.

## DEMONSTRATIONAL AND EDUCATIONAL WORK AGAINST HOG CHOLERA.

The demonstrational and educational work, with the object of enlisting the aid of the farmers in combating hog cholera, is conducted in cooperation with the State colleges, each State being regarded as a unit. The plan has been for the department to work through and with existing agencies in the State rather than with individual farmers. This work was begun in 1914 in 17 States, as follows: Alabama, Arkansas, California, Florida, Georgia, Indiana, Iowa, Kansas, Louisiana, Massachusetts, Nebraska, North Carolina, Oklahoma, Oregon, Texas, Virginia, and Wisconsin. The outbreak of foot-and-mouth disease in the fall of 1914 made it necessary to withdraw men from this educational work and to discontinue it in Indiana, Iowa, Kansas, Louisiana, Massachusetts, Nebraska, Oregon, and Wisconsin.

The work of the inspectors may be summarized as follows: Addresses numbering 1,505 were made at meetings, and 378 were illustrated by stereopticon views. The total attendance was 100,000. Six hundred and sixty-two demonstrations of preventive treatment were made, 394 with the use of serum alone and 268 with simultaneous inoculation. The total attendance at these demonstrations was 20,061. Thirty-two demonstrations of ridding premises of infection were made, and 414 farmers were reached in that way. One thousand and seventy-seven visits were made to farms for the purpose of diagnosing hog cholera or observing conditions and giving advice, and 7,085 farmers and hog raisers were personally interviewed. Individual instruction in properly administering the serum preventive treatment was given to 1,093 people, including 339 county agents, 70 practicing veterinarians, and 684 hog owners.

State colleges generally report that this work has been productive of a great amount of good. It undoubtedly provides a splendid foundation for future efforts toward eradication or control.

## ENFORCEMENT OF THE VIRUS-SERUM-TOXIN ACT OF 1913.

The work relating to the enforcement of the act of 1913 governing the preparation and importation of viruses, serums, toxins, etc., for the treatment of domestic animals is divided between the Pathological and Biochemic Divisions of the bureau. The work of the former division has already been stated, but for convenience the entire work will be summarized here.

Licenses for the manufacture for interstate trade and permits for the importation of such products are issued for calendar years. From July 1 to December 31, 1914, licenses were issued to 40 plants, and from January 1 to June 30, 1915, to 102 plants, some of the latter licenses being reissues of the former. The total number of licenses issued during the fiscal year, including such reissues, was therefore 142. Two permits for importation were issued. The 102 licensed plants are located in 48 cities in 17 States. Two hearings were held as provided by law. Information was furnished to the solicitor for 13 successful prosecutions for violations of the law.

Eighty of the 102 plants licensed at the close of the fiscal year were licensed to manufacture anti-hog-cholera serum and hog-cholera



virus. From January 1 to November 30, 1914, there was produced at such plants 140,963,343 cubic centimeters of the serum, of which 2,812,003 cubic centimeters was pronounced worthless or contaminated and withheld from market as a result of the bureau's inspection.

To procure men for inspection work in enforcing this law has been one of the greatest difficulties of the work. The number of inspectors at the beginning of the fiscal year was 19; the number employed at the end of the year was 42. These men were selected from other lines of work in the bureau service because of their supposed special fitness, and were given a careful course of training in methods of inspection of virus and serum plants, as well as in methods of serum production.

The establishments licensed to produce anti-hog-cholera serum have improved greatly during the fiscal year both in construction of plants and in methods of operation.

The outbreak of foot-and-mouth disease in the fall of 1914 was a distinct menace to plants producing anti-hog-cholera serum and hog-cholera virus. The serum and virus respectively consist of defibrinated blood of immune hogs in the one case and of hogs sick with hog cholera in the other. The virus of foot-and-mouth disease in the case of hogs appears in the blood of the affected animal before the characteristic lesions of this disease develop. Therefore it is possible for an animal to be simultaneously affected with hog cholera and foot-and-mouth disease.

If a hog is killed for the production of virus at a time when the foot-and-mouth disease infection is in its early stages, such blood might convey the infection of foot-and-mouth disease. Apparently this did occur in the fall of 1914, when a small lot of virus derived from four pigs appeared to be infected. These pigs were slaughtered for virus at a time when they showed no lesions of foot-and-mouth disease.

In August, 1915, as already stated (page 7), certain cases of foot-and-mouth disease were produced by one lot of infected hog-cholera serum, the infection of which with the virus of foot-and-mouth disease was discovered only after prolonged tests.

In view of this danger strict requirements were made of licensed hog-cholera serum plants located in areas quarantined against foot-and-mouth disease. No new stock was allowed to be brought on the premises. The disinfection of yards, pens, buildings, etc., was required, and the shipment of neither serum nor virus was permitted until the Federal quarantine was lifted. In the case of plants located in free areas, new stock was admitted only when originating outside of quarantined areas and accompanied by certificate that the farm of origin was free of foot-and-mouth disease. All incoming stock was inspected, the premises disinfected as a precautionary measure, and quarantine of the premises maintained by the owner. All serum has to be tested on pigs which are inspected for foot-and-mouth disease, and all virus for simultaneous inoculation must have added to it 1 per cent of carbolic acid and must be held at the plant until it has been found to be free of foot-and-mouth disease infection by a test on calves.

## THE ZOOLOGICAL DIVISION.

The Zoological Division, under Dr. B. H. Ransom, chief, has continued the investigation of parasitic diseases of animals and the study, collection, and determination of animal parasites.

## TRICHINOSIS, MEASLES, ETC.

Further investigations on the effect of cold upon trichinæ have conclusively demonstrated that trichinous pork may be rendered innocuous by exposure to low temperatures. Slight infections have been produced experimentally by meat exposed to a temperature of 10° to 13° F. for 19 days, and heavy infections by meat exposed to a temperature of about 15° F. for 20 days, but the infectiousness of trichinæ has not persisted longer than the tenth day in meat refrigerated at a temperature of 5° F.

The discovery that the vitality of trichinæ may be destroyed by refrigeration has obviated the necessity of considering further the question of undertaking a necessarily expensive microscopic inspection of pork products prepared customarily to be eaten without cooking. Such products may be rendered safe by refrigerating the pork from which they are manufactured at a temperature of not higher than 5° F. for a period of 20 days. It seems advisable to adopt 20 days as a proper length of time for refrigeration rather than a shorter period in order that there may be an ample margin of safety.

Investigations have also been made of the effects of curing processes upon trichinæ, and it has been found that sausage and hams of kinds prepared customarily to be eaten without cooking may be rendered safe if certain methods are followed in their preparation. It is expected that provision will be made whereby establishments operating under Federal inspection may be enabled to employ these methods in the preparation of such products, as an alternative to refrigeration.

In the course of a trip of investigation to Alaska, some live cysticerci, the cause of measles in reindeer, were procured and fed to dogs, in which adult tapeworms (presumably *Tania krabbei*) developed as a result. Egg-bearing segments of these tapeworms fed to sheep and calves failed to produce tapeworm cysts, from which it may be concluded that the parasite is not readily transmissible (if at all) to either sheep or cattle, and that there is little likelihood of live stock in the United States becoming infested with reindeer measles through the importation of reindeer meat from Alaska. Dogs in Alaska were found to harbor, in addition to the reindeer measles tapeworm, the dangerous hydatid tapeworm. The prevalence of these two tapeworms in Alaska calls for the adoption of certain prophylactic measures with reference to dogs associated with the reindeer herds in order to prevent damage to the meat from measles in the one case and the spread of hydatid disease among human beings in the other.

## ROUNDWORMS OF SHEEP.

In order to continue the investigations upon stomach worms and other internal parasites of sheep a farm of about 160 acres near Vienna, Va., has been rented. During the first year of occupancy

a study has been made of various methods of pasturing sheep with reference to their effects upon stomach worm infestation. The results are not yet available.

#### INVESTIGATIONS OF PARASITIC PROTOZOA.

In a study of the life history of Sarcosporidia it has been found that the so-called spores penetrate into the intestinal cells and there develop into male and female elements within a few hours. This is the most important advance which has been made in elucidating the life history of these forms since the discovery that animals could be infested by feeding meat containing the spores of the parasites.

#### INDEX-CATALOGUE AND COLLECTION OF PARASITES.

The index-catalogue to the literature of medical and veterinary zoology has continued to grow and now contains twice as many references as when its publication was commenced in 1902. As a means of keeping track of the immense amount of information which has been collected by numerous workers all over the world, and which is constantly being added to, it is of the highest value and enables one to get together in a short time practically everything that has been published upon any phase of the subject of parasitology.

The collection of parasites maintained by the division for reference purposes has been added to during the year, specimens having been received from various sources both in this country and abroad.

#### DIPS TO DESTROY TICKS, ETC.

The outbreak of foot-and-mouth disease interfered so seriously with the investigations of the use of dips in the treatment of live stock for cattle ticks, mange mites, and other external parasites that very little was done during the year. The work was resumed June 1.

One series of experiments was carried out in cooperation with the Field Inspection and Biochemic Divisions. The results indicated that arsenical dips containing unoxidized arsenic (sodium arsenite) equivalent to about 0.2 per cent arsenic trioxid might contain in addition sufficient oxidized arsenic (sodium arsenate) to give a total arsenic content equivalent to about 0.6 per cent arsenic trioxid without injuriously affecting cattle dipped in the solution. If these results are confirmed, it will be demonstrated that in testing arsenical baths used for eradicating ticks only the content of unoxidized arsenic need be considered, as a rule. In other words, if the field test shows that the percentage of unoxidized arsenic in the bath is below standard, sufficient arsenic may be added to restore the strength without fear that the total percentage of arsenic will be raised so high that injury to the cattle will result.

A series of investigations on the treatment of sheep to destroy sheep ticks was carried out under cooperation between the Salt Lake City field station of the bureau and the Utah board of sheep commissioners. Dips containing cresylic acid were found to be effective, but decision on the question of the most suitable remedies for sheep ticks is reserved pending investigations now in progress.



## OTHER WORK.

Various remedies and methods of treatment for intestinal worms in hogs were tested. Oil of chenopodium was found to be the most efficacious of the remedies tested. The dose is 45 drops for a pig weighing from 50 to 100 pounds. Each pig should be dosed separately, and should receive at the same time about an ounce of castor oil. Mixing the remedy with slop or ground feed and thus dosing a number of hogs at once was found to be unsatisfactory.

Further investigations on anthelmintics and methods of treating live stock for internal parasites have been begun, with the view of establishing the relative value of the numerous remedies which may be used against parasites and of determining the best methods of administration.

Certain studies on the nematodes of rodents, tapeworms of carnivores, discodrilid worms, *Fasciola magna* in sheep, *Syngamus laryngeus* in cattle, the dog as a carrier of parasites, the life history of *Gongylonema*, and abnormalities in tapeworms were completed and have either been published or are ready for publication.

Examinations were made of 120 imported sheep dogs with reference to the presence of parasites injurious to live stock, particularly the gid tapeworm. Fifty-three of the dogs were found to be infested with parasites, and of these 14 harbored tapeworms, none of which, however, were gid tapeworms. Seventy-two examinations were made of dogs allowed entrance into establishments operating under Federal meat inspection for the purpose of destroying rats. In 21 of the examinations parasites were found, but tapeworms were present in only 2 dogs.

The division has cooperated with the Insecticide and Fungicide Board by testing various proprietary articles for which claims were made by the manufacturers with reference to their use as remedies for external or internal parasites of live stock, and an expert witness was supplied to the board in one case tried in the courts.

As usual, numerous inquiries from correspondents in all parts of the country concerning parasites and parasitic diseases of live stock were received and replied to, and numerous specimens of parasites were identified for members of the field force of the bureau, stock owners, veterinarians, physicians, and others.

## THE MISCELLANEOUS DIVISION.

The Miscellaneous Division, of which Dr. A. M. Farrington is chief, was organized July 1, 1914, and is charged with attention to miscellaneous correspondence and other matters which it is not practicable to have handled by the other divisions. It keeps records and prepares data pertaining to the various projects of the bureau. It maintains records and conducts correspondence regarding civil-service examinations for positions in the bureau, appointments to such positions, promotions, demotions, transfers, removals, the conduct of employees as to efficiency, the acceptance by employees of outside employment, and other matters relating to the general subject of personnel. It also conducts correspondence and makes tours of inspection relative to the supervision which the bureau maintains over veterinary educational institutions under department regulations.

## BUREAU PERSONNEL.

At the beginning of the fiscal year the persons in the employ of the bureau numbered 3,572. During the year there were 1,730 additions, as follows: Appointments, 1,659; transfers from other branches of the Government service, 35; reinstatements, 36. During the same period there were 1,196 separations from the service, as follows: Resignations, 235; deaths, 34; removals for cause, 7; transfers to other bureaus or departments of the Government, 30; all other separations, 890. The last item includes terminations of appointments by limitation and for administrative reasons, exclusive of separations for disciplinary reasons. On June 30, 1915, the bureau personnel numbered 4,106, a net increase of 534 over the number a year ago. Of these, 2,726 were in the meat-inspection service.

The new work undertaken for the eradication of foot-and-mouth disease alone necessitated the transfer of approximately 750 employees to that work from the various branches of the service. It was necessary, of course, in nearly every instance to replace each man transferred. Nearly all of these employees were returned to their regular work after the disease was under control, and all of the temporary appointments which were made necessary to replace regular men transferred were terminated. During the year 11 civil-service examinations were requested and subjects and weights furnished to the Civil Service Commission.

## VETERINARY EDUCATION.

For some years the Department of Agriculture has cooperated with the Civil Service Commission in establishing a list of accredited veterinary colleges, the graduates of which are eligible for the civil-service examination for veterinary inspector in this bureau. This action was taken for the purpose of obtaining competent, well-trained veterinarians to act as inspectors. Regulations were promulgated stating under what conditions a college was accredited and what subjects should be taught. A college that fails to meet the demands of these regulations is removed from the list and its graduates are excluded from the civil-service examination until such time as there is compliance with the conditions set out in the regulations. A new college must also show a compliance with the regulations before it is added to the list. This fact requires the bureau to keep in touch with the veterinary colleges, and this is done through the Miscellaneous Division.

During the year one veterinary college, the Royal Superior Veterinary School of Naples, Italy, was added to the accredited list. The list now comprises 21 American and 8 foreign colleges. For the session of 1914-15 there were enrolled at these American colleges 2,550 students, an increase of 106 over the preceding session. Of these, 698 completed the course of study and were graduated at the end of the session, being 14 more than the number of graduates for the previous session.

## THE EXPERIMENT STATION.

The work of the experiment station at Bethesda, Md., under Dr. E. C. Schroeder, superintendent, was of the same general character as in previous years. It consisted of tests and studies, made both

independently and in cooperation with other divisions of the bureau, regarding infectious diseases of animals, and the provision of facilities required by the other divisions for making tests and studies on large animals under farm and field conditions.

During a considerable portion of the year the regular work of the station was handicapped because the services of a part of the small technical staff were needed in the bureau's campaign against foot-and-mouth disease. In addition to this, unexpected work was laid upon the station in the form of tests with material suspected to be infected with the virus of foot-and-mouth disease from various portions of the country.

As the work for and in cooperation with other divisions of the bureau has already been presented, this part of the report will be confined almost entirely to the independent work of the station.

#### TUBERCULOSIS INVESTIGATIONS.

Studies on tuberculosis, which have been in progress for a number of years and are being continued, justify several conclusions, as follows:

(1) That the propagation of tuberculosis among cattle depends more largely on actual contact between tuberculous and healthy cattle than on any other possible cause of infection.

(2) That no wide separation between stables and pens occupied by tuberculous and healthy herds of cattle is necessary to protect the latter against infectious material discharged by the former.

(3) That, in the preparation of stables which have been occupied by tuberculous cattle and are subsequently to be occupied by healthy cattle or other animals, a thorough cleaning is a factor of possibly even greater importance than the use of disinfectants.

(4) That tuberculosis among hogs depends almost exclusively on the direct exposure of hogs to tuberculous cattle and to material derived from such cattle, and only very slightly on the exposure of healthy to tuberculous hogs.

A detailed account of the experiments on which these conclusions are based can not be given in this report, but the following brief statement may give some idea of their character.

No case of tuberculosis that can not be accounted for as the result of direct contact between healthy and tuberculous cattle has developed among the cattle at the station for more than a dozen years, notwithstanding that several groups of tuberculous cattle and an equal or larger number of groups of nontuberculous cattle have been maintained year after year on an area measuring less than 50 acres. Contrary to this, several cases of tuberculosis have arisen from positively known but seemingly slight contact between healthy and tuberculous animals. For example, in two instances bulls which were permitted to serve tuberculous cows on neutral ground—that is, on ground neither in their own pens nor in the pens occupied by the tuberculous cows—became affected with tuberculosis. Excepting at the time of service these bulls were carefully protected against all exposure to tubercle bacilli.

An avenue less than 2 rods wide between two parallel stables, one occupied by a herd of tuberculous and the other by a herd of healthy



cattle, proved amply sufficient to prevent the transference of tuberculosis from one stable to the other. The doors and windows of the stables facing the narrow avenue were open during warm weather and were not screened or made dust proof or fly proof. This exposure test continued for about 6 years. An experiment is still in progress in which a separation of only a few feet between small fields or paddocks occupied respectively by tuberculous and healthy cattle in proving sufficient for the protection of the latter against infectious material from the former.

What can be accomplished by cleanliness in the fight to control and eradicate tuberculosis among domestic animals is shown by the following test: A healthy herd of cattle was moved into and permitted to remain a year in a stable which had been occupied for 5 or 6 years by a large herd of tuberculous cattle. Not one case of tuberculosis developed among the healthy cattle. The treatment this stable received after the removal of the tuberculous and before the installation of the healthy herd was limited to a thorough cleaning. While it is not justifiable on the basis of this test to advocate the abandonment of the use of strong germicides to disinfect stables which have been occupied and infected by tuberculous cattle, the need for cleaning up thoroughly before germicides are used can not be too strongly emphasized. Probably a thorough cleaning will not prove sufficient in all cases.

During the year additional tests proved that tuberculosis does not seem to spread seriously among hogs through the exposure of healthy to tuberculous hogs, and experiments in which tuberculous sows were bred indicate that it is safer for a pig to be the offspring of a tuberculous mother than to be exposed to the manure of a tuberculous cow. Though hogs are frequently attacked by tuberculosis, they are not important agents for the perpetuation of the disease, which would almost certainly cease to exist among them if constant accretions of tuberculous material from cattle did not provide for its persistence and increasing frequency.

Experiments in the treatment of tuberculosis have given no satisfactory or promising results, but are being continued.

Further studies on the occurrence of tubercle bacilli in the circulating blood of tuberculous animals, with special reference to the possibly increased frequency of such bacilli in the blood after tuberculin tests, have been made. As with our earlier studies, positive results were obtained only with animals affected with more or less generalized tuberculosis which had advanced close to a fatal termination. The injection of tuberculin did not cause a discoverable increase of tubercle bacilli in the circulating blood. Many investigators have studied this subject, and it is regrettable that the results they report are exceedingly contradictory, which makes additional work urgently necessary.

Additional investigations regarding the persistence of tubercle bacilli in the tissues of rats which have been exposed to tuberculosis through infected food show that months may elapse before the body of a rat which has eaten infected food is free from tubercle bacilli. Rats permitted to eat tuberculous guinea-pig tissues for only a single day and then removed to a tuberculosis-free environment have repeatedly been proved to harbor tubercle bacilli in their lungs 3 months later.

## INFECTIOUS ABORTION OF CATTLE.

The most important result of the station's work on the subject of infectious abortion of cattle during the year is that positive evidence has been obtained that the placentas of cows which have aborted are sometimes infected with abortion bacilli at subsequent normal parturition. This means that it is easily possible for abortion disease to find its way into previously clean herds through the agency of seemingly normal cows of which the history relative to abortion disease is not known.

Tests have also been made to determine whether a recrudescence of abortion bacilli occurs in the sexual organs of cows which have at some time aborted during the monthly estrual period. Such tests have so far proved negative.

Further observations have shown wide variations relative to the occurrence of the bacillus of infectious abortion in the milk of cows which have aborted. Some cows continue to produce infected milk for years; others for shorter periods of time; some produce such infected milk intermittently; and the milk of some entirely escapes becoming infected. The relation between these variations and the power of the milk and blood serum of the cows to agglutinate abortion bacilli has received some attention, and further work on this subject is contemplated.

## OTHER WORK.

Comparative feeding tests with raw, pasteurized, and boiled milk have been continued. When the milk of a foreign species is substituted for the natural milk of a species as food for its unweaned young, the results with an almost germ-free raw milk are about equal to those obtained with equally good pasteurized milk, and the results with boiled milk are somewhat better.

Several tests have been made in the course of the year regarding the commercial tuberculin sold for veterinary use under Federal licenses and permits. With one exception all samples were found to be satisfactory.

During the year the usual number of guinea pigs, rabbits, etc., were raised for the use of the scientific divisions of the bureau and a number of minor investigations made which require no special attention at the present time.

## PUBLICATIONS.

Sixty-two new publications, comprising 1,299 printed pages, were issued or contributed by the bureau during the fiscal year. These included 12 Farmers' Bulletins, 10 Department Bulletins, 7 papers in the Journal of Agricultural Research, 13 issues of Service and Regulatory Announcements, and 20 miscellaneous pamphlets. The bureau also furnished material for numerous articles in the Weekly News Letter and the Departmental Circular. Several papers were also contributed to outside scientific and technical publications. In addition 88 orders in the nature of regulations were issued and a number of former publications were reissued.

**EXPERIMENTS AND DEMONSTRATIONS IN LIVE-STOCK PRODUCTION  
IN THE CANE-SUGAR AND COTTON DISTRICTS.**

A miscellaneous item in the appropriation bill for the fiscal year ended June 30, 1915, provided \$60,000 for experiments and demonstrations in live-stock production in the cane-sugar and cotton districts of the United States. To administer this fund the Secretary appointed the following-named committee: W. A. Taylor, Chief of Bureau of Plant Industry, chairman; B. H. Rawl, Chief of Dairy Division, Bureau of Animal Industry; W. R. Dodson, director, Louisiana Experiment Station, and director of extension service, Louisiana State University.

After an investigation of conditions in the cane sugar and adjoining districts, it was planned to devote a part of this fund to live-stock demonstrations and the remainder to a live-stock experiment farm, to be used in testing out on a commercial scale the various methods of live-stock production and management applicable to the conditions of that region.

The live-stock extension work has been organized under the direct supervision of Director W. R. Dodson, so that it could be articulated with the other extension and demonstration work of the State. Dr. G. E. Nesom was selected to take charge of the work, with a secretary, and with field specialists in beef cattle, dairy cattle, poultry, swine, and forage crops; and a market specialist was recently (Aug. 8, 1915) added to the force. At first institutes and short courses were conducted to familiarize the specialists with Louisiana conditions, then demonstration work was begun in cooperation with the county agents. At the end of the year the following demonstrations were being conducted: Thirty with farm poultry and 4 in commercial poultry plants, in 13 parishes; 31 with hogs, in 10 parishes; and 22 with beef cattle, in 13 parishes. The dairy specialist assisted in building 8 new dairy barns, 6 dairy houses, 13 concrete and 23 stave silos, and helped remodel a number of dairy barns and houses. A number of dairymen have begun record work. At the State fair demonstrations of milk testing, buttermaking, etc., were given. A creamery was established at the university to utilize the cream of the dairymen in that vicinity. The forage crop expert has introduced proper cropping systems on the farms where the various cattle, hog, and poultry demonstrations are made. As soon as the demonstrations begin to produce visible results the residents of the community will be invited to informal meetings to observe what is being accomplished.

A farm of 500 acres at New Iberia, La., has been deeded to the United States Department of Agriculture by the State of Louisiana, and has been divided into four small farms for work with horses and mules, beef cattle, dairy cattle and hogs, and hogs alone. The plan is to determine here the amount of work a brood mare, suitable to produce large mules, can do compared with a mule; the amount of feed she will consume compared with a mule; and whether high-class mules can be produced in that region, and at what cost; the cost of producing a steer, using grass as much as possible and wintering on the various kinds of silage; the possibilities of finishing steers in that region, using the various kinds of cheap roughage available,



supplemented with cottonseed meal and other concentrated feeds; the different rotations to use on hog farms, and the cost of pork production; the testing of the various methods that might be practicable on the average dairy farm, and the production of hogs on a dairy farm with skim milk compared with the raising of hogs on other farms.

A beef-cattle barn, a horse barn, a jack barn, a tool and machinery shed, a well house, a hog feed house, hog cots, and a cattle dipping vat have been erected.

As a result of this experimental work it is hoped that methods will be developed that will make possible the profitable raising of some kind of live stock on every farm in Louisiana, either as an independent feature or as an adjunct to some other kind of farming.

# REPORT OF THE CHIEF OF THE BUREAU OF PLANT INDUSTRY.

UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF PLANT INDUSTRY,  
*Washington, D. C., October 14, 1915.*

SIR: I have the honor to submit herewith a report of the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1915.

Respectfully,

WM. A. TAYLOR,  
*Chief of Bureau.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

The Bureau of Plant Industry is concerned chiefly with the broad problems of crop production and crop utilization. The wide scope of these activities, the diversity of the fundamental researches which may establish, protect, or improve different crops, the occasional sudden appearance of new destructive diseases or the unexpected development of other agricultural emergencies require an organization of unusual flexibility. The investigational staff, therefore, is divided into many independent offices, each with a definite allotment of funds and with authority for specific investigations. Minor emergencies within the field of the plant industries usually can be met through active cooperation between the units most nearly concerned. At present the following offices are established:

Laboratory of Plant Pathology.....	Erwin F. Smith, Pathologist in Charge.
Pathological Collections.....	Flora W. Patterson, Mycologist in Charge.
Fruit-Disease Investigations.....	M. B. Waite, Pathologist in Charge.
Investigations in Forest Pathology..	Haven Metcalf, Pathologist in Charge.
Cotton and Truck Disease Investi- gations.....	W. A. Orton, Pathologist in Charge.
Crop Physiology and Breeding In- vestigations.....	W. T. Swingle, Physiologist in Charge.
Soil-Bacteriology and Plant Nutri- tion Investigations .....	Directed by Karl F. Kellerman, Assistant Chief of Bureau.
Soil-Fertility Investigations.....	Oswald Schreiner, Biochemist in Charge.
Acclimatization and Adaptation of Crop Plants: Cotton Breeding.....	O. F. Cook, Bionomist in Charge.
Drug-Plant, Poisonous-Plant, Phys- iological, and Fermentation In- vestigations.....	R. H. True and W. W. Stockberger, Phys- iologists in Charge.
Agricultural Technology.....	N. A. Cobb, Technologist in Charge.
Fiber-Plant Investigations.....	L. H. Dewey, Botanist in Charge.
Grain Standardization.....	J. W. T. Duvel, Technologist in Charge.

Biophysical Investigations-----	Lyman J. Briggs, Biophysicist in Charge.
Seed-Testing Laboratories-----	E. Brown, Botanist in Charge.
Cereal Investigations-----	M. A. Carleton, Cerealist in Charge.
Corn Investigations-----	C. P. Hartley, Physiologist in Charge.
Tobacco Investigations-----	W. W. Garner, Physiologist in Charge.
Paper-Plant Investigations-----	Directed by C. J. Brand, Chief of Office of Markets and Rural Organization.
Alkali and Drought-Resistant Plant Investigations-----	T. H. Kearney, Physiologist in Charge.
Sugar-Beet Investigations-----	C. O. Townsend, Pathologist in Charge.
Economic and Systematic Botany---	Frederick V. Coville, Botanist in Charge.
Dry-Land Agriculture Investigations---	E. C. Chilcott, Agriculturist in Charge.
Western Irrigation Agriculture-----	C. S. Scofield, Agriculturist in Charge.
Horticultural and Pomological In- vestigations-----	L. C. Corbett, Horticulturist in Charge.
Arlington Experimental Farm-----	Directed by L. C. Corbett.
Experimental Gardens and Grounds---	E. M. Byrnes, Assistant in Charge.
Foreign Seed and Plant Introduc- tion-----	David Fairchild, Agricultural Explorer in Charge.
Forage-Crop Investigations-----	C. V. Piper, Agrostologist in Charge.
Congressional Seed Distribution---	R. A. Oakley, Agronomist in Charge.
Demonstrations on Reclamation Proj- ects-----	F. D. Farrell, Agriculturist in Charge.

From September 1, 1914, to August 31, 1915, the changes in the personnel of the bureau were as follows: Resignations, 579; deaths, 17; removals, 3; transfers from bureau, 1,987; furloughs, 38; terminations of appointments, 1,045, making a total of 3,669 employees dropped from the rolls during that period. There have been made in the same period 2,045 appointments, decreasing the total force of the bureau by 1,624. Of the 1,987 transfers from the bureau, 1,979 were made on July 1, 1915, in order to conform to the agricultural appropriation act for the fiscal year 1916, such changes in personnel being incident to the transfer of the farmers' cooperative demonstration work in the South and the farmers' cooperative demonstrations in the Northern and Western States from this bureau to the States Relations Service; the farm management investigations to the Office of the Secretary; the work in farm architecture to the Office of Public Roads and Rural Engineering; the cotton-standardization work to the Office of Markets and Rural Organization; and the investigations of stock poisoning by plants to the Bureau of Animal Industry. In connection with the transfer of soil-fertility investigations from the Bureau of Soils to this bureau, 14 transfers of employees from the Bureau of Soils to this bureau were made. On September 1, 1915, the numerical strength of the bureau was as follows: In Washington, 799; outside of Washington, 645; total, 1,444. The total number of employees in the bureau on the same date a year ago was 3,068.

In connection with the fiscal operations of the bureau 9,755 requisitions for supplies were issued, 27,820 accounts were received and examined, 161 requests for contracts and leases were made, 3,646 letters of authorization were drawn, and 3,858 freight and express shipments were received and sent out.

More than a million letters, including letters printed on duplicating machines, have been sent out from the bureau during the year.

The new publications of the bureau number 130, with a total of 2,837 pages, and were issued in editions aggregating 3,859,300 copies. The number of contributions made by this bureau to the series of



Farmers' Bulletins was 28. Twenty-seven papers were contributed to the Journal of Agricultural Research and were afterwards reprinted in separate form. Two papers were contributed to the Yearbook of the Department of Agriculture and these also were reprinted in separate form for special distribution. The publications of the bureau (not including Farmers' Bulletins) reprinted during the year total 23.

No attempt is made in this brief report to outline the full work of the bureau. Certain of the more striking results of the investigational work, however, that have become evident during the year are here summarized.

### PLANT PATHOLOGICAL INVESTIGATIONS.

**CITRUS CANCER.**—During the summer of 1914 a new disease of citrus trees, called citrus canker, was reported to Washington. The information secured on hasty trips through various infected regions convinced this department that the citrus industry was facing an emergency of unusual gravity, yet there were no funds under either State or Federal control adequate to make any effective attempt to check the spread of the citrus-canker disease. Considerable sums were contributed by the growers themselves, and organizations were effected for accomplishing the actual burning of all diseased trees, which appeared to be the only method of disease control promising any success. An appropriation of \$35,000 carried in the general deficiency bill became available January 25, 1915, and immediately co-operative arrangements were entered into with Florida and soon after with the remaining Gulf States on an approximately half-and-half basis, the department carrying the salaries and expenses of pathological inspectors, the expenses of men engaged in actual destruction of trees being borne by the respective States. The work of inspection and eradication has progressed very satisfactorily, although the seriousness of the disease and the number of localities infested are much greater than was at first supposed. Because of the extreme ease of transmitting infection from tree to tree by contact with animals or by insects, the disease has not yet been eradicated. In Texas, Mississippi, and Alabama it appears that the greater portion of the diseased areas have been determined and the diseased trees destroyed. If it is possible for these States to maintain a thorough inspection during the coming year there is reason to hope for the complete eradication of citrus canker from these regions.

In Florida the infected areas and the areas which are under suspicion appear to be safeguarded by the present system of inspection, although the complete elimination of the disease from this State will probably require expenditures of considerable magnitude for at least two years more.

Up to the present time it is estimated that the Gulf States have expended approximately \$50,000 in eradication work. The department has spent approximately \$33,000 for this purpose.

The bureau has determined the cause of the citrus canker disease to be a new species of bacteria, to which the name *Pseudomonas citri* Hasse has been given. In the hope of developing new methods of disease control, experimental work is being conducted by this bureau

only under quarantine greenhouse conditions at Washington. This experimental work, however, is now being financed from the allotment for Fruit-Disease Investigations.

**BITTER-ROT OVERWINTERING.**—During the past year spraying experiments for the control of apple blotch and apple bitter-rot by various fungicides have been continued. The special feature of this work has been the discovery of the overwintering of the bitter-rot fungus on various small and minor cankers and on cankers and injuries produced by other causes, and the demonstration that when these are removed full control of bitter-rot can be obtained.

**WHITE-PINE BLISTER RUST.**—The work of eradicating the white-pine blister rust has proceeded as heretofore, by assisting the State authorities in positive identification of the disease in questionable cases, by helping eradication efforts by personal examinations and suggestions as to the most efficient methods, and by urging State officials to a uniform and efficient general policy. One new outbreak of the disease was discovered in a plantation of 50,000 nine-year-old trees. At the request of the State officials, the diseased area was examined and recommendations were made, which were followed in destroying all the pines and many wild *Ribes* of the vicinity upon which the disease passes one stage of its existence. A similar request from the Dominion authorities of Canada was answered by a personal examination of the area and advice given as to the most efficient methods to use. The total destruction of infected lots of white pines is becoming recognized as desirable, and a strong public opinion is developing in favor of it.

**COTTON DISEASES.**—Cooperative breeding and dissemination of disease-resistant cotton and cowpeas in South Carolina, Georgia, and Alabama have been continued. In South Carolina thirteen cooperative breeders and twenty-three cooperative growers planted 579 acres of wilt-resistant cotton and produced 5,005 bushels of select seed for sale. In Georgia thirty cooperative breeders and five cooperative growers produced 6,750 bushels of wilt-resistant cotton seed for sale.

**FLAX CANKER.**—In the study of flax diseases an effort has been made to determine the cause of flax canker, a troublesome disease in flax-growing sections west of the Missouri River. The attempts to isolate a fungus thought by some to be the cause have thus far given negative results. In the study of the flax wilt organism field plot experiments and laboratory experiments have been conducted to determine the physiology of infection.

**CEREAL RUSTS.**—Additional data on rust-resistant hybrids have been accumulated and emphasis has been placed on determining the relation of growth factors to rust epidemics and special work has been undertaken at Akron, Colo., on this project. Extensive milling and baking tests have been inaugurated with several rust-resistant spring-wheat hybrids grown at St. Paul, Minn.

**CEREAL SMUTS.**—A careful experimental study is being made relative to the control of infection by the loose smuts of wheat and barley and some progress has been made in developing a means of prevention. Methods for the prevention of bunt, covered smut of barley, and oat smut are being tested. Important data have been

recorded on the relation of soil temperature and soil moisture to infection of wheat by the bunt organism, and on the relation of crop rotation to the control of this disease.

**ROOT DISEASES OF WHEAT AND OATS.**—An extensive study of wheat soil "sickness" has been begun with a view to determining the cause or causes of poor yields on soil cropped consecutively for many years with a single cereal; and further to study methods of restoring such soil to its maximum crop capacity. From wheat and oats showing evidence of root diseases three species of imperfect fungi have been isolated that may prove to be causes of the crop injury.

**PLANT-INFESTING NEMATODES.**—It has been found that nematodes can be introduced on importations of sugar-beet seed. Living specimens of three different species have been found, none of which, however, are known to be dangerous parasites. Dead specimens of *Heterodera schachtii*, the sugar-beet nematode which is frequently the cause of serious loss, have been determined, but up to the present time no living specimens have been discovered. The identity of species *Tylenchus biformis*, which has been found attacking sugar cane and bananas in Hawaii, has been determined.

#### PLANT PHYSIOLOGICAL INVESTIGATIONS.

**TOBACCO "GRAIN," MOSAIC, ETC.**—The minute structure of the tobacco leaf, with special reference to the so-called "grain," has been extensively studied. The nature of the "grain" has been ascertained and it has been found that the character of the "grain" and the extent of its development have an important influence on the commercial quality of the leaf. An investigation of the causes of poor burning qualities of cigar leaf has shown that the use of fertilizers high in chlorine is an important factor and that poor burn of tobacco from certain areas is correlated with lack of grain development. During the past year further advances have been made in the study of the mosaic disease, especially with reference to the distribution of the virus in the plant parts and its relation to certain constituents of the plant. The results indicate that the disease is parasitic rather than physiological. In a study of the ripening of the tobacco leaf it has been found that the process is analogous to curing in the barn in many respects, and that the more important changes taking place are chiefly dependent on seasonal conditions rather than on the character of the soil. Work on the relation of potash to the development of the tobacco plant and its important qualities has been continued, and it has been found that lack of this element produces very characteristic pathological symptoms which can be easily recognized by farmers.

**WATER REQUIREMENT.**—Water-requirement measurements have shown that crop plants differ markedly in their efficiency in the use of water. The most efficient crop plants so far investigated are the millets and sorghums, which under dry-land conditions require from 250 to 350 pounds of water for each pound of dry matter produced, while alfalfa has the highest water requirement of the crop plants. Not only do the various crops exhibit a great range in water requirement, but marked differences are also found in the water requirement of different varieties of the same crop. Grimm alfalfa, for example, requires 200 pounds more water than Peruvian



alfalfa for the production of a pound of dry matter. Measurements of this kind give promise of being very helpful in the selection of varieties and strains of crop plants suitable for use in semiarid regions where the efficient use of the rainfall or of irrigation water is fundamental to the best agricultural development.

**PHYSIOLOGICAL STUDIES OF PARASITIC FUNGI.**—Study of the methods by which parasitic organisms affecting fruits and vegetables attack their hosts has shown that in general the parasites make use of stored food products in the plants. Study of the conditions affecting pigment production in the group of parasites which includes the chestnut-blight organism has made it possible to determine by the colors produced whether the forms in question are actively parasitic or merely saprophytic.

**CULTURE DISTRIBUTION.**—In accordance with the policy of the last few years pure cultures of nodule-forming bacteria for inoculating leguminous crops were distributed, cultures for inoculating approximately 214,257 acres of legumes having been distributed during the fiscal year 1915, or three times as many as during the previous fiscal year. This distribution is partly for the purpose of stimulating the use of leguminous plants in planning crop rotations and partly for the purpose of developing the best methods of managing the preparation and distribution of pure cultures. With the recent improvements in handling these cultures an efficiency for crop improvement equal to that from the use of old soil has been secured.

**POISONOUS-PLANT INVESTIGATIONS.**—Investigations of poisonous plants thus far have demonstrated the poisonous nature of *Oxytropis lamberti* and *Astragalus mollissimus*, two of the more serious sources of loss from loco, and of all the larkspurs and of certain species of *Zygadenus*, or death camas, have been demonstrated. Losses of stock caused by poisonous plants on the ranges were investigated in the Absaroka, Colville, La Sal, Chiricahua, Fremont, Manti, Fish Lake, Fillmore, Kaibab, and Plumas National Forests, and methods of treating poisoned animals were pointed out.

#### PLANT-BREEDING INVESTIGATIONS.

**SOUTHERN PROLIFIC TYPES OF CORN.**—By means of variety tests it has been determined that the "southern prolific" type of corn can be grown advantageously over a much wider territory than it is at present. In tests conducted in localities where these types are not now generally grown it was found the small-eared prolific types gave larger yields and a greater percentage of sound corn than the large single-eared types commonly grown. Seed of suitable prolific varieties has been introduced into a number of localities and the adoption of these varieties is advocated.

**BREEDING METHODS FOR CORN: INDIAN AND CHINESE VARIETIES.**—A study of the characters in corn hybrids has shown that they behave in a very different manner from those of many other cultivated plants. With most crops the key to successful breeding is the recognition and purification of desirable types. In corn, on the contrary, the variations do not appear as definite types. As a demonstration of the utilization of this knowledge it was possible as a result of only

three seasons' work to combine into a uniform strain the sweet seeds and prolific habit of sweet corn with the long harsh husks of southern varieties of field corn, thus producing a variety of sweet corn as resistant to the corn worms as the southern varieties of field corn. Studies of thirty different varieties of corn grown by the American Indians have demonstrated that in these varieties there are many adaptations, the value of which seems to have been overlooked. The Assiniboine and Mandan Tribes have both sweet and field varieties that surpass commercial varieties in earliness. Others, particularly the Omaha and Otoe Tribes, have varieties showing a remarkable development of slender leafy stalks suitable for forage. It is planned to continue the study of these and other Indian varieties with a view to providing breeding material for the improvement of commercial strains. The drought-resistant qualities of Chinese waxy corn have been repeatedly demonstrated and the possibility of developing useful hybrid varieties is being investigated, but the direct use of this type of corn for purposes of crop production has seemed to be excluded by the small yield of the individual plant. Experiments at San Antonio, Tex., have shown that satisfactory yields can be secured by closer spacing and that ears are regularly produced when the plants stand only two inches apart.

**DATE OFFSHOOT PROPAGATION.**—The investigations on the rapid propagation of date offshoots at the Government date garden, Indio, Cal., have proved that warmth and humidity are great aids in rooting date offshoots. It has also been found that cold frames without artificial heat, made by putting canvas frames over the offshoots in the field, aid in forcing a rapid and healthy growth. The majority of the offshoots imported by private growers in the Imperial and Coachella Valleys are being rooted in the field by the use of this cold-frame method.

**CANKER-RESISTANT CITROUS FRUITS.**—A trip was made to Japan, China, and other oriental countries to determine the possibility of securing citrous fruits resistant to citrus canker (caused by *Pseudomonas citri*), a disease which has resulted in great damage to grapefruit plantations in Florida. This disease was found to be widely spread in southern Japan, southern China, and the Philippine Islands, and as no attempt at eradication had been made in these countries it was possible to secure valuable data relative to the comparative canker resistance of different varieties. It was found that the pomelos (commonly called Buntan in Japan) were decidedly resistant to canker, some of the varieties examined having suffered no appreciable damage from the attacks of this disease. In view of the fine quality of many of these pomelos, which are similar to the shaddocks of Florida and the West Indies, it is believed that hybrids between them and the ordinary grapefruit can be secured which will possess the resistance to canker shown by the Buntan, while retaining the desirable characteristics of the grapefruit. Through a new method for the long-distance shipment of pollen, developed in connection with the investigations of the past year, grapefruit pollen was sent from Florida to Japan and used successfully in making crosses between the grapefruit and selected varieties of the Japanese pomelo.

**CACTUS.**—During the past year work on yields of six or seven varieties of prickly pear in southern Texas has been completed. Three hardy, smooth forms, secured by selection during past years, have fruited and crosses have been made with them and the tender, rapid-growing spineless forms.

**FLAX.**—Breeding and selection of flax varieties started two years ago at Mandan, N. Dak., and Moccasin, Mont., have progressed to the point where many promising strains are being increased for field trial. Second-generation hybrids of promise are being studied both with regard to superior new strains and for further information in heredity. The best yielding strains now being grown in variety trials are being selected for uniformity to type, and additional new importations have been secured and are being tested together with varieties previously secured.

### AGRONOMIC INVESTIGATIONS.

**IRRIGATION PASTURE.**—At Huntley, Mont., special attention has been given to crops needed in live-stock industries. It has been shown that here a well-established pasture of mixed grasses and clovers may carry at least two cows per acre for five months, and that with alfalfa pasture supplemented by a proper grain ration the production of pork should become a profitable industry. Investigations have been extended in the direction of determining the best seed mixtures to use for grass pastures and the best methods of establishing and handling them.

**CITRUS-FRUIT IMPROVEMENT.**—The work which has been carried on with citrus fruits has conclusively demonstrated that under the soil and environmental conditions existing in the citrus sections of California, within the recognized varieties of both oranges and lemons grown in the region, a number of trees which are unprofitable are to be found. These trees occupy as much space and require as much attention as those which produce profitable crops. The existence of such trees in a plantation led to an investigation to determine if it is possible to work out a plan by which such unprofitable trees can be eliminated, the idea being to avoid the planting of such trees, or when such trees are discovered in a plantation to top-work them.

**DRY-LAND AGRICULTURE INVESTIGATIONS.**—The agricultural development of the Great Plains lying between the 98th meridian and the eastern foothills of the Rocky Mountains presents one of the greatest agricultural problems of this country. Owing to the fact that these plains consist mainly of fertile land, capable of producing large and profitable crops of most of the staple crops during seasons of sufficient rainfall, but that these favorable climatic conditions can not be depended upon, this region has been the scene of unremitting agricultural effort for a period of nearly forty years. These efforts have involved enormous losses in the shape of broken fortunes, deserted farms, and ruined homes. Probably nowhere else on the North American continent has there been so large a number of people hopelessly ruined by agricultural efforts as in this region. It would seem that this enormous loss ought to have been compensated for, in a measure at least, by the accumulated experience of these pioneer farmers, but this fund of accumulated experience is woefully meager.



The experience of individual farmers, who kept little or no record of their operations or the results from them, and who were consequently not prepared to trace the connection between cause and effect, and whose experiences have been an alternation of phenomenal yields, in favorable seasons, obtained by even the crudest and most unscientific methods, with total crop failures following the most approved methods, does not constitute a safe basis for reliable conclusions. These conditions have, however, afforded opportunity for the exploitation of many theories, methods, and systems of farming and have been taken advantage of by self-seeking adventurers and land speculators who have enticed settlers into these regions by holding out hopes to them that through some newly discovered method success was assured. Experience has shown that none of these systems were effective in overcoming the effects of severe and long-continued droughts.

It became apparent to the department investigators many years ago that it would be necessary to undertake some extensive and thoroughly coordinated and systematic investigations in this region for the purpose of collecting facts that would constitute a basis for correlating the factors of seasonal climatic conditions, cultural methods, soils, crops, and yields. It was not, however, until July 1, 1905, that definite measures were taken to put this plan into operation, and the Office of Dry-Land Agriculture Investigations was then established. The work of this office has developed steadily since that time until it now has 23 field stations in the Great Plains, where these investigations are being carried on. An immense amount of valuable data has been secured and seven publications have been issued within the last year dealing with these problems. The conclusion drawn from these investigations may be briefly summarized as follows: This entire region is capable of supporting a permanent and profitable agriculture, but this will be accomplished by reducing the cost of production rather than by increasing yields by any new system of cultural methods; by making live-stock production rather than grain raising the major farm enterprise; and by carrying over the surplus crops of favorable years to supplement the scanty crops of unfavorable seasons rather than by depending upon intensive systems of cultivation to overcome the effects of severe droughts.

**NEW DRY-LAND STATIONS.**—Two new field stations have been established, one at Lawton, Okla., and the other at Big Spring, Tex. Both of these are independent stations, the one at Lawton being located on a tract of 160 acres and the one at Big Spring, 130 acres. In both instances the title to the land was acquired by the Government for the use of the Department of Agriculture. At both stations a superintendent's house, an office and laboratory building, and a barn, implement shed, and seed house have been erected. The farms have been fenced, land broken, and crops are being raised during the present season. At Big Spring the land has been laid out in plats and the investigational work has been begun. At Lawton the plats have not been laid out, but the land has been planted to general farm crops and the plats will be laid out for the investigational work in time for fall seeding. Both stations have been well equipped with teams, implements, tools, and all other necessary facilities for conducting the investigational and cooperative work.

**COTTON CULTURE.**—The new single-stalk system of cotton culture has been further developed and definite steps have been taken to extend its general application. The principles of this system have been explained in detail in earlier publications. The most recent bulletin issued gives the results obtained at San Antonio, Tex., where increased yields of from 40 to 121 per cent were obtained from single-stalk culture as compared with common methods. In a number of other experiments earlier and larger yields have been obtained, the rows treated by the new system often exceeding the others by from 30 to 50 per cent. Plans have been completed whereby a number of demonstration experiments are being conducted in cooperation with the Office of Extension Work in the South of the States Relations Service for the purpose of demonstrating the adaptability of single-stalk culture to the various sections of the cotton belt.

**CLOVER.**—In cooperation with the experiment stations in the States of Indiana, Iowa, and North Dakota, studies on the pollination and fertilization of red-clover blossoms have been pursued. The importance of these studies is indicated not alone by the steadily advancing price of red-clover seed, but by the bearing of the results on the problem of selecting hardier and more productive strains of clover. Clover seedings fail more frequently than they did formerly, and farmers hesitate to risk seeding clover. The causes of these failures are, however, not yet well understood.

From being called a weed sweet clover has during the past few years leaped into the front rank of valuable forage crops and soil improvers. The possibility of a still wider use of this plant is being investigated, and a series of experiments has been planned designed to determine the best methods for its culture.

The commercial production of crimson-clover seed has been studied and a machine has been developed to facilitate the harvesting of the seed.

**GENERAL SURVEY OF SUGAR-BEET SECTIONS.**—A general survey of the recognized sugar-beet sections has been made with a view to determining which of these sections are best suited to sugar-beet culture and which are not suited to this crop. This work comprised not only a study of soil, climatic, and water conditions but also a study of labor, marketing, crop competition, diseases, and all other factors of a general nature bearing upon this problem. Of the seventy-seven existing sugar-beet sections located in seventeen States the majority of them appear to be wisely located with reference to the factors which make for success. Some of the mills are poorly located with reference to one or more of the factors considered.

#### STUDIES OF NEW CROP PLANTS AND CROP EXTENSION.

**HEMP.**—During the present season the area devoted to seed hemp has been increased to approximately 800 acres. About three-fourths of this is of the Minnesota No. 8 variety, developed by this bureau in cooperation with the Minnesota State Experiment Station. This variety is superior both for fiber production and for seed production. It is therefore more profitable for the grower producing seed to be sown for the production of fiber crops, and because of its increased

yield of fiber it is more profitable also for the fiber producer. Variety selection is being continued by this department for the further improvement of special strains.

**SUDAN GRASS.**—Sudan grass, introduced by the department and first distributed in 1912, has proved remarkably successful as a hay crop in the Middle and Southwestern States, and the acreage now planted is very large. Numerous related varieties have now been secured from Africa and are being tested, especially the dwarf varieties with larger grain that may be harvested like oats.

**DENIA ONION SEED.**—It has been determined that in several important localities high-grade onions of the Denia type can be produced from imported seed. Several lots of American-grown seed have been produced, and from this bulbs of high quality have resulted, thus indicating that it may be possible to successfully produce in this country a grade of Denia onion seed which will give results quite as satisfactory as have been obtained from imported seed.

**CHINESE DRY-LAND ELM.**—Tests of the Chinese dry-land elm (*Ulmus pumila*) carried on in nursery rows at Mandan, N. Dak., have shown this tree to be exceptionally well adapted both to the climatic and soil conditions of this region, and it is therefore believed that this species will become a valuable shelter-belt and ornamental tree for the northern plains region. Much more extensive plantings throughout various areas of this region will be completed by the close of the present season.

**JUJUBES.**—Previous introductions of jujubes, which were distributed in 1906 and 1907, are beginning to bear fruit in various parts of the country. The trees have withstood temperatures of 22° below zero and appear to be promising for dooryard culture at least in the loess soils of the Great Plains region. They have grown well in central Texas and Arizona, and wide distributions are being prepared for. The department has already a considerable collection of varieties of this fruit, of which in China there are believed to be hundreds of distinct different sorts.

**FOREIGN EXPLORATIONS.**—The agricultural exploration of China has resulted in the discovery and introduction of several promising plants, the more important of which are special varieties of persimmons, which are used on a large scale for drying purposes by the Chinese, and large-fruited varieties of the Chinese chestnut. A species of this chestnut introduced in 1906 has proved resistant to the bark disease.

**ACCLIMATIZATION OF THE AVOCADO IN THE UNITED STATES.**—As a result of the numerous experimental plantings that have been made in California and Florida, the eventual development of a large industry comparable to that of citrus-fruit production is to be expected. Though still unfamiliar to the American public, the avocado is a food product of high nutritive value, and is adopted as a regular article of diet by most of the European and American residents of Tropical America. With adequate supplies available at low prices the consumption of this tropical fruit might be expected to attain large proportions as in the case of the banana.



**DURANGO COTTON.**—The Durango cotton, recently acclimatized from Mexico, affords a striking illustration of plant adaptability to a wide range of natural conditions in the United States. Early experiments have shown its superiority to other long-staple types in the Southwestern States, where it is now being grown extensively as a commercial crop. More recent experiments with the Durango cotton at Norfolk, Va., and at Easley, S. C., show that this new type of cotton is distinctly earlier than the Columbia variety, even under the eastern conditions where the Columbia cotton was originated, and has been selected for earliness for several generations. The more upright habit and more open foliage of the Durango cotton represent a further advantage over the Columbia. Further experiments are being made to test the adaptability of the Durango to eastern conditions in other respects and to determine the possibility of a general substitution of Durango for Columbia.

**NEW AND RARE FIELD SEEDS.**—For the fiscal year 1915 an appropriation of \$100,000 was made for the purchase, propagation, testing, and distribution of new and rare field seeds, and the distribution of such seeds was made throughout the entire United States. This distribution was in effect a development from the provision in the appropriation bills for 1912-13 and 1913-14 for the purchase, propagation, testing, and distribution of drought-resistant field seeds, and replaced that item. The distribution had for its object the dissemination of seed of new and rare field crops, seed of improved strains of staple crops, and high-grade seed of crops new to sections where the data of the department indicate such crops to be of considerable promise. Each package contained a sufficient quantity of seed for a satisfactory field trial, and the recipient was urged to use the seed for the production of stocks for future plantings. A report card and a circular, giving full directions for the culture of the crop, accompanied each package of seed. Only seed of new crops or of improved strains of standard crops were distributed, including the following: Canadian, Grimm, Peruvian, Baltic, and Kansas-grown alfalfas; *Bromus inermis*; alsike, red, sweet, and white clovers; New Era, Groit, Brabham, Iron, and Early Buff varieties of cowpeas; the Golden Vine, Prussian Blue, Bangalia, Amraoti, Kaiser, and Khaba varieties of field peas; a grass mixture for hay and pasture; Natal grass; orchard grass; Rhodes grass; tall meadow oat grass; Schrock kafir; lespedeza; Kursk millet; dwarf milo; rape; Italian rye grass; the Mammoth Yellow, Haberlandt, Peking, Tokio, Manchu, Black Eye-Brown, and Barchet varieties of soy beans; Sudan grass; Sumac sorghum; timothy; the Florida, Lyon, Chinese, Yokohama, and Hundred-Day Speckled varieties of velvet beans; and the Columbia, Dixie, Durango, Holdon, Lone Star, and Trice varieties of cotton.

During the year 275,814 packages of new and rare field seeds were distributed, including 106,770 packages of cotton seed. The results obtained have been very gratifying, indicating the value of a distribution of this kind. Such a distribution enables a farmer to procure seed of new and improved crops in sufficient quantities to produce similar stocks for future seeding, thus resulting in materially improving the crops of the country.

## CROP UTILIZATION.

**FLAX-STRAW UTILIZATION.**—Flax straw appears more promising for paper making than any material investigated heretofore. Laboratory work on this material has prepared the way for definite progress in several lines of paper testing. Practical and commercial-sized co-operative tests have been conducted with two fiber-board manufacturers. Merchantable products were produced which the manufacturers were able to sell to the trade at a profit. These products were a fiber board used in trunk manufacture and a counter board used extensively in shoe manufacture.

**CROP UTILIZATION ON RECLAMATION PROJECTS.**—In 1914 more than 50 per cent of the area from which crops were harvested on 23 Government reclamation projects was devoted to the production of hay crops and about 30 per cent to the production of cereals. These crops do not bear well the cost of transportation from the projects to the consuming centers, so that it is necessary that there be established on the projects agricultural industries through which the hay and cereals produced can be converted into live-stock products which can be marketed at a profit. On some projects the farmers have no difficulty in producing abundant crops of hay, but they have serious difficulty in producing satisfactory crops to use in supplementing hay as a feed for live stock.

**SWEET POTATOES.**—Plans and specifications for storage houses for the crop have been provided by the department and suggestions regarding the location, building, and management of these houses offered. Attention has also been given to testing the adaptation of different varieties to the several sections in which sweet potatoes are grown for storage purposes. The value of desiccated sweet potatoes as a food for cattle and hogs has been investigated. This work has been carried on in cooperation with the Bureau of Animal Industry, the Office of Horticulture and Pomology of this bureau providing the desiccated products and the Bureau of Animal Industry furnishing the stock and conducting the feeding tests. The results indicate that desiccated sweet potatoes form an excellent basis for a ration for growing hogs.

**OIL-PLANT INVESTIGATIONS.**—Investigations of the utilization of waste cherry pits for the production of valuable oils contained in them have been practically completed and the results prepared for publication. Investigations of the extraction of oil from tomato pulp and other sources of cannery waste, and special studies of oils from oil-seed crops, have been undertaken.

## INVESTIGATION OF CROP HANDLING AND STANDARDIZATION.

**COMMON STORAGE FOR APPLES.**—Studies of proper methods for operating common storage houses have shown that through careful attention to the management of the common storage houses now existing in the Northwest much greater effectiveness can be secured and crops can be marketed in better condition and to better advantage. A publication outlining the management of common storage houses will be issued shortly.

**CELERY STORAGE.**—Celery harvested in New York, as well as celery harvested in Florida, has been transported to storage houses and held in receptacles of different types to determine the keeping qualities of celery stored in standard crates such as are ordinarily used in New York and California, as well as in partitioned crates of the same type and in half crates. After two years of investigation it is evident that the storage period of celery can be extended at least thirty days by placing the celery to be stored, provided it has been well grown and is free from disease at the time of harvesting, in crates one-half the size of the standard crates used in the New York and California regions.

**GRAPES IN SAWDUST.**—Storage and shipping investigations in California table grapes have been continued, and the results of this work have been utilized by the industry so that in three years the delivery of table grapes packed in redwood sawdust to eastern markets for the Christmas trade has increased from one car in 1911 to 300 cars in 1914.

**ORANGE PRECOOLING IN FLORIDA.**—The orange handling and precooling work in Florida has shown that not only is decay from blue mold lessened for the first ten days of the market period by precooling but sometimes serious results from stem-end decay can be almost entirely avoided or eliminated during this period. This has been demonstrated not only in the department's experimental shipments but in the shipments from commercial packing houses.

**PINEAPPLE HANDLING.**—The pineapple handling and precooling work has been continued, and this season's results conclusively demonstrate the practicability of placing plant-ripened fruit on the eastern markets of the United States; in fact, the plant-ripened product which was carefully and quickly handled and precooled before shipment and transported under full icing to eastern markets attracted unusual attention for its quality and appearance.

**CORN GRADES.**—The official grades for commercial corn were established July 1, 1914. These grades specify definite maximum limits of moisture, damage, dirt, foreign matter, etc., and "cracked" corn for each of the six numerical grades. Investigations during the year show that these grades, which have been adopted throughout the whole of the corn belt, have had a noticeable beneficial effect upon the quality and condition of the corn as delivered from the farm to the country elevators, in that the farmers are not only delivering corn that is cleaner, but they are also picking out the damaged ears, both of which tend to put the grain into a higher grade. The factor of moisture content determines the commercial grade of corn more frequently than any other factor during the first three or four months following a new harvest, and because of this farmers are now recognizing the value of storing their corn in properly constructed cribs, built to exclude rain and snow and with good ventilation to facilitate drying and prevent deterioration.

**SAMPLING DEVICE.**—Since the Federal corn grades provide definite maximum limits for damage, dirt, etc., and "cracked" corn, it has become necessary for the grain men and the inspectors to be able to secure accurate samples for analyses. Investigations of the vari-



ous methods and apparatus ordinarily used by the grain trade and inspection departments to reduce the original sample to a portion sufficiently small for convenient and rapid analysis disclosed the fact that there was no apparatus on the market which would do the dividing accurately enough for consistent results. In order to provide a reliable mixing and sampling device for the determination of the proper grade of grain, a special device was designed and a patent applied for which, if granted, will be for the free use of the people of the United States.

**APPLICATION OF ACIDITY TEST.**—An improved method of determining grain acidity, developed in connection with determination of the soundness of corn, has been extended to apply to other grains. Until recently the method required from 16 to 20 hours to complete a determination, but a modification of the method has been completed whereby the determination can be made within an hour.

**RICE HANDLING.**—Investigations relating to the harvesting, handling, storing, and grading of rice indicate that the milling quality of rice is in a large degree dependent upon the protection given the grain while in the shock and the variable weather conditions prevailing during the harvest season. Experiments to determine the breakage of rice indicate that only a very slight damage results from handling and shipping. Factors considered in the commercial grading of rough rice and of clean rice were studied with a view to establishing definite standard grades thereof.

### INVESTIGATION OF QUALITY OF SEED.

**SEED MIXING IN GINS.**—One of the chief causes of deterioration in cotton varieties is the mixture of seed at custom gins as they are ordinarily operated. When seed containing a mixture of several varieties is planted ideal conditions are provided for cross-fertilization and rapid deterioration results. A method has been devised whereby the extent to which mixing occurs at custom gins can be determined with reasonable accuracy. Since the amount of mixing is much greater and hence far more serious than is commonly supposed, growers and ginners will be urged to cooperate to reduce this objectionable condition to a minimum.

**POTATO INSPECTION.**—The informal cooperation of pathologists of this department in the movement for the improvement of seed potatoes by State inspection and certification has aided its rapid progress during the year. Particular attention is given to the newer troubles disseminated through seed tubers, such as leaf-roll, curly dwarf, mosaic, wilt, etc., and to other potato seed improvement problems. Much benefit to the potato industry is resulting from this movement, through the production of better seed and increasing interest in disease-control and marketing problems.

**IMPORTED SEED.**—As a result of the disturbed condition in Europe there has been a shortage in the supply of many seeds normally imported and the quality of others has been poor. Less than one-fourth as much hairy vetch seed was imported in 1915 as in 1914. Some of this has been badly adulterated with weed vetches, one importation containing only 5 per cent of hairy vetch seed. At present

there is no way to prevent the importation of adulterated hairy vetch seed, as it is not subject to the seed-importation act. More than 1,000,000 pounds of the crimson-clover seed imported during May and June, 1915, germinated less than 62 per cent, the lowest germination determined being only 29 per cent. While much of this dead seed may be mixed with better seed before going to the consumer, it will eventually all be paid for by the farmer and seeded in the vain hope of securing a stand.

**GROUND WEED SEEDS.**—An examination of the commercial practice of grinding screenings used in compounding mixed feeds including molasses feeds showed that the methods regularly employed in the best mills insure the killing of practically all weed seeds contained in the screenings. There appears to be no reason to suppose, therefore, that the weed seeds in screenings can not be economically and effectively ground.

**SUGAR-BEET SEED.**—The difficulty in procuring beet seed because of European conditions has aroused the seed growers and sugar companies in this country to the importance of growing our own seed. Some efforts have been made in this direction for the past 20 years, but this year will show a scattered acreage from Michigan through to the Pacific coast. A considerable portion of it is grown purely for experimental purposes, to determine whether or not beet seed of a good quality can be grown at a reasonable price. This bureau is cooperating with the sugar companies in this work both to improve the quality of the seed and the beets and to improve the methods of seed production.

## REPORT OF THE FORESTER.

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UNITED STATES DEPARTMENT OF AGRICULTURE,

FOREST SERVICE,

Washington, D. C., October 14, 1915.

SIR: I have the honor to transmit herewith a report of the work of the Forest Service for the fiscal year ended June 30, 1915.

Respectfully,

HENRY S. GRAVES, *Forester.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### THE NATIONAL FORESTS.

Presidential proclamations and Executive orders excluded from the National Forests last year 1,107,224 acres of land. By acts of Congress 26,618 acres were added. Area recomputations reduced the figures of total acreage by 9,987 acres. The result was to leave within the National Forest boundaries on June 30, 1915, 184,505,602 acres, including 21,732,322 acres of alienated land. The net National Forest area, or, in other words, the area actually owned by the public, was at the close of the year 162,773,280 acres.

The Black Hills and Sundance Forests in South Dakota and Wyoming, the Jemez and Pecos Forests in New Mexico, the Cache and Pocatello Forests in Utah and Idaho, the Sequoia and Kern Forests in California, the Michigan and Marquette Forests in Michigan, and the Moapa and Toiyabe in Nevada were consolidated, and the Nebo Forest was incorporated in neighboring Forests in Utah, by Executive orders, which, however, did not become effective until July 1, 1915. In consequence of these changes the number of the National Forests at the beginning of the new year was 155, as against 163, July 1, 1914.

These Forests are administered through an organization which groups them in large districts, each with its central office in charge of a District Forester. The number of these districts was increased from 6 to 7 on July 1, 1914, through the creation of a new district, with headquarters at Washington. Previously the nearest district office to Washington was that at Denver. While the great bulk of the National Forests lie in the far Western States, the need for administering as Forests the lands purchased in the southern Appalachian and White Mountains called for the creation of a new district in the East. By adding to the 15 so-called "Purchase Areas" in the New England and Southeastern States the two Forests in Arkansas, the Florida Forest, and the Wichita Forest and game



preserve in Oklahoma, formerly administered as part of District 3 from Albuquerque, N. Mex., a suitable new unit was formed. A large purchase of land in North Carolina during the year added a sixteenth Purchase Area, the Boone, which is now under administration as a part of District 7.

#### COST AND RETURNS.

The cost of protecting the Forests was increased beyond the normal by an extraordinarily severe fire season, necessitating emergency expenditures which were partly provided for through a deficiency appropriation, passed January 26, 1915, of \$349,243. Of the regular appropriation for the Forest Service of \$5,662,094.13 carried by the Agricultural appropriation act, approximately \$5,281,000 was expended for the protection, utilization, and improvement of the National Forests, including all overhead administrative costs. From the special fund provided for public roads and trails on the Forests, consisting of 10 per cent of the National Forest receipts, an additional sum of approximately \$196,000 was spent.

The expenditures include the cost of handling the business connected with the utilization of the Forests and of protecting the timber and other resources which at present do not bring in any direct cash return to the Government. They include protecting the timber which at present is inaccessible, but which will be of great importance to provide for later demands for timber and which will produce a direct future return. The outlay covers, further, the protection of mountain watersheds, whose returns are measured by general public benefits. No attempt, however, is made in connection with the expenditures for administering and protecting the Forests to distinguish between the outlay necessary to provide for the present use and the outlay which might properly be charged against future returns or against watershed protection and other general benefits.

During the past fiscal year the National Forest cash receipts were \$2,481,469.35, from the following sources: Timber, \$1,175,133.95; grazing, \$1,130,495; and special uses, \$175,840.40. This represents an increase of \$43,759.14 over the year 1914. The increase of cash earnings was not as great as would have occurred under normal conditions. The depressed lumber market furnishes the reason. That the increase will be more rapid during the fiscal year 1916 is already clear, since the first three months show an increase of \$118,834.36 over the earnings of the same period in the year 1915.

In addition to the timber which was sold, there was given away a large amount of material to settlers free of cost, and a considerable quantity of timber was also sold at cost. The value of the timber given away amounted to \$206,464.13. The value of the timber sold at cost was some \$33,000 greater than the amount received by the Government. The revenue foregone through free use of grazing lands is estimated to exceed \$120,000. There were many special miscellaneous uses of National Forest lands which are free of charge, though their administration involves some expense. A moderate charge for these miscellaneous uses would yield approximately \$100,000. The values represented by the free use of timber and other privileges granted free in the Forests have never been entered formally as a credit to the Forest business. They nevertheless should

be considered among the very definite returns from the National Forests. In addition there are the general benefits not measurable in terms of money value, but of great public importance, such as the benefits of watershed protection and of the utilization of all resources along lines that make for stable industrial and community development without monopoly.

#### CLAIMS, ALIENATIONS, AND LAND CLASSIFICATION.

During the year 881 individual tracts of land passed into private ownership through the patenting of claims. Of these 360 were homestead, 2 timber and stone, 501 mineral, 17 coal, and 1 miscellaneous.

The chief source of alienation is the opening of lands to homesteading under the Forest Homestead Act. This is based on land classification. The land classification work also furnishes the basis for recommending eliminations from the Forests of areas found not to be chiefly valuable for Forest purposes. This work is proceeding rapidly as a result of the special appropriation for it. At the close of the fiscal year a total gross area of 18,707,127 acres had been classified through final action of the Secretary of Agriculture upon reports of special field parties engaged in this work. Of this amount 3,349,215 acres was alienated land taken up before the creation of the Forests or already listed under the Forest Homestead Act. Naturally these alienations comprised as a rule the pick of the land classified. The Government land totaled 15,357,912 acres. Of this 216,375 acres was classified as chiefly valuable for agriculture. In addition 97,523 acres was found which may be suitable for farming after the removal of the present heavy stand of valuable timber. Action was suspended on such tracts until the timber is removed. The remaining land proved to be chiefly valuable for forest purposes.

In addition to the classification work done by special field parties, many small tracts were examined at the request of individual applicants. There were thus listed and opened to entry 2,356 individual tracts, covering 238,525 acres. At the end of the year the number of individual tracts listed since the passage of the Forest Homestead Act was 18,020, with a total of 1,920,608 acres thus opened to settlement.

As a further result of the classification work, 1,107,224 acres was eliminated from the National Forests. The larger areas classified as agricultural were thus dealt with, as well as areas of low value for forest purposes, some of which was believed to have possible value for farm purposes. Other eliminations with a total area of 7,507,536 acres which had been recommended by the Forest Service and had received the approval of the Secretary of Agriculture were awaiting the action of the Department of the Interior and the President; the Forests and areas involved were: Chugach, 5,800,000 acres; Cleveland, 749,730 acres; Dixie, 567,800 acres; Paulina, 127,219 acres; and Kansas, 262,787 acres.

#### FOREST MANAGEMENT.

The sales of timber during the past year have brought out clearly both the relation of the National Forest timber to local supply and development and its relation to the general lumber industry and lumber needs of the country. While a widespread depression in the lumber industry curtailed the output of many mills and decreased the

demand for stumpage, in regions where the public timber is cut chiefly for local use purchases from the National Forests were normal in volume and in some instances increased. The total number of sales, over 95 per cent of which are in small quantities for local needs, registered a marked advance over any former year. The sales to settlers and farmers at cost rates nearly doubled in number and quantity of material as compared with 1914, the transactions of this character increasing from 2,341 to 4,562. There was also an increase of 549 in the permits issued for free use of timber, bringing the total above 40,000; and an increase of 439 in the number of small sales at commercial rates. All told, 50,811 separate lots of timber were disposed of during the year in free use or small sales for local purposes, aside from a number of large operations whose cut is utilized wholly by local industries or in local development.

This is the use of the timber in the public Forests which contributes directly to community upbuilding and the prosperity and expansion of local industries. Under this use timber is obtained for many western mines, from the small prospect which requires perhaps a single wagonload to the largest copper mines in Montana which consume 400,000 pieces annually; for the railroads traversing National Forest States; for irrigation enterprises; for salmon packing cases at the Alaskan canneries and boxes and trays in many western fruit districts; and for farm and town uses in hundreds of communities in or near the National Forests. The steady increase in this use, notwithstanding a diminished cut of timber in the country as a whole, indicates the importance of the National Forests to the communities in which they are located and the stability of the demand for their products.

On the other hand, the depressed lumber market, mentioned in last year's report, and accentuated by the outbreak of the European war, was reflected in a decreasing volume of business for the general trade. There was a decrease of 33 per cent in the number of sales for quantities of timber exceeding \$1,000 in value. Since the greater part of the timber cut enters the general market, this decrease is reflected in the total volume of sales and cut for the year. The former dropped 30 per cent below that of 1914 and the latter 11 per cent. The drop of 30 per cent in the demand for National Forest stumpage, as indicated by the falling off in new sales, is a significant index of the unstable market for lumber and the serious conditions now obtaining in the forest-using industries.

These conditions are the subject of a special study conducted by the Department of Agriculture, in cooperation with the Federal Trade Commission and the Bureau of Foreign and Domestic Commerce, the conclusions of which will be presented in due time. It is clear, however, that they are related primarily to the carrying of enormous quantities of raw material, exploitable only during a long period of time, in private ownership. This load of uncut timber, with its far-reaching financial burdens, hampers or prevents the private operator from adapting his business to the changed conditions of his market and to the competitive factors of more or less recent development. Hence a tendency toward a lumber output governed not by the requirements of the country, but by the financial necessities of the owners of stumpage, with its resultant market demoralization and wasteful use of timber resources. Had the National Forests



never been created, the conditions of trade depression and wasteful exploitation, detrimental alike to the interests of the lumber industry and the public, would have been markedly accentuated. The value of public ownership of a considerable part of the timber resources of the Nation has never been demonstrated more strikingly than by the results of private ownership now manifest.

The average price of stumpage disposed of in commercial sales during the year was \$2.48 per thousand board feet. The increase of 16 cents over the average price of 1914 was due chiefly to large sales of western yellow pine in Oregon, easily logged and of unusual quality. The average stumpage price obtained in the sales of different years is not necessarily indicative of general price movements, since it is likely to be raised or lowered by the accident of location of a few large sales; if such sales, covering operations for a term of years, happen to be made in bodies of high-priced timber, an illusive appearance of rising prices is brought about. Broadly speaking, there has been no increase in the value of western stumpage during the past eight years, and hence no ground for a general advance in the prices of National Forest timber.

## TIMBER SALES BUSINESS OF THE YEAR.

In the following table are given the quantities and values of timber cut and sold, by States. For convenience in tabulation, material of all kinds has been converted into board feet, log scale.

*Timber sold and cut under commercial sales on the National Forests, fiscal year 1915.*

State.	Timber sold.		Timber cut.	
	Quantity.	Value.	Quantity.	Value.
	<i>Board feet.</i>		<i>Board feet.</i>	
Arizona.....	83,234,000	\$197,487.84	40,015,000	\$95,911.95
Arkansas.....	21,946,000	70,208.06	11,682,000	37,683.22
California.....	32,251,000	61,647.59	35,841,000	78,400.33
Colorado.....	68,765,000	133,381.80	40,987,000	76,550.70
Florida.....	110,000	87.94	99,000	83.48
Georgia.....	10,000	7.50		
Idaho.....	73,023,000	156,587.07	95,674,000	230,694.17
Michigan.....	294,000	618.10	83,000	303.48
Minnesota.....	1,581,000	7,503.20	1,532,000	7,269.90
Montana.....	78,874,000	120,857.76	95,691,000	185,757.93
Nevada.....	1,678,000	5,014.94	2,434,000	6,191.58
New Mexico.....	13,861,000	26,262.90	17,716,000	42,311.04
North Carolina.....	1,299,000	645.71	828,000	456.97
Oregon.....	544,673,000	1,629,041.79	47,179,000	96,236.66
South Dakota.....	20,440,000	50,818.72	18,715,000	41,586.08
Tennessee.....	20,450,000	259.05	34,000	65.03
Utah.....	18,930,000	49,492.39	23,697,000	62,381.09
Virginia.....	1,148,000	1,501.20	1,383,000	1,137.76
Washington.....	27,854,000	34,867.28	42,286,000	75,556.15
Wyoming.....	16,959,000	35,135.72	33,472,000	81,038.64
Alaska.....	62,498,000	68,672.02	37,160,000	45,652.25
Total, 1915.....	1,069,578,000	2,650,098.58	546,508,000	1,165,268.43
Total, 1914.....	1,525,877,000	3,535,959.16	616,661,000	1,264,530.18
Total commercial sales, 1915.....	1,069,578,000	2,650,098.58	546,508,000	1,165,268.43
Total sales at cost, 1915.....	24,011,000	17,606.30	19,246,000	14,179.96
Grand total, 1915.....	1,093,589,000	2,667,704.88	565,754,000	1,179,448.39

In addition to sales of timber, sales of naval stores on the Florida National Forest aggregated 114,000 cups during the year, with a total value of \$3,415.85.

The following tables give (1) the total number of sales, classified by amount, and (2) the sales of timber at cost to settlers and farmers.

*Number of timber sales, classified according to amount of sale, fiscal year 1915.*

[Cost sales included.]

State.	\$100 or under.	\$101 to \$500.	\$501 to \$1,000.	\$1,001 to \$5,000.	Over \$5,000.	Total number of sales.
Arizona.....	468	9	2	1	1	481
Arkansas.....	88	5	4	5	6	108
California.....	861	9	8	3	2	883
Colorado.....	1,066	19	8	15	5	1,113
Florida.....	14					14
Georgia.....	1					1
Idaho.....	1,887	9	6	17	9	1,928
Michigan.....	15	4				16
Minnesota.....	10	2	1		1	14
Montana.....	2,451	24	9	6	3	2,493
Nevada.....	323	5				328
New Mexico.....	393	3	2	4	1	403
North Carolina.....	27					27
Oregon.....	724	3	2	1	4	734
South Dakota.....	417	2	1	3	2	425
Tennessee.....	15	2				17
Utah.....	1,087	7	4	2	3	1,103
Virginia.....	16	1	1			18
Washington.....	122	3	3	3	1	132
Wyoming.....	346	12	1	2	1	362
Alaska.....	290	1	6	7	1	305
Total, 1915.....	10,621	117	58	69	40	10,905
Total, 1914.....	7,926	146	64	108	54	8,298

*Timber sold and cut at cost rates, fiscal year 1915.*

State.	Number of sales.	Timber sold.		Timber cut.	
		Quantity.	Price at cost.	Quantity.	Price at cost.
Arizona.....	39	<i>Board feet.</i> 112,000	\$83.40	<i>Board feet.</i> 61,000	\$51.58
Arkansas.....	30	86,000	69.14	82,000	63.26
California.....	304	1,715,000	941.36	1,274,000	707.91
Colorado.....	335	2,387,000	1,647.40	1,622,000	1,244.96
Florida.....					
Georgia.....					
Idaho.....	1,174	6,174,000	4,610.22	5,119,000	3,834.11
Minnesota.....	3	10,000	7.50	13,000	9.68
Montana.....	1,507	7,401,000	6,076.13	5,693,000	4,683.14
Nevada.....	79	390,000	227.46	369,000	222.18
New Mexico.....	51	215,000	200.14	103,000	104.97
Oregon.....	462	2,283,000	1,302.68	2,235,000	1,248.44
South Dakota.....	147	1,211,000	900.26	1,244,000	929.80
Utah.....	272	1,142,000	900.40	697,000	551.26
Washington.....	15	110,000	56.65	92,000	45.59
Wyoming.....	144	775,000	583.56	642,000	483.08
Alaska.....					
Total, 1915.....	4,562	24,011,000	17,606.30	19,246,000	14,179.96
Total, 1914.....	2,341	14,207,000	10,035.34	9,645,000	6,569.98

Thus the timber cut under these sales cost the settlers and farmers who obtained it an average of 74 cents per thousand board feet, as against an average of \$2.48 realized by the Government under commercial sales. Assuming that the average value of the selected and relatively high-class material disposed of under cost sales was no greater than that of the timber commercially cut, the cost-rate

sales represent the equivalent of approximately \$33,500 of National Forest revenue made available by Congress for the benefit of certain classes of citizens.

## FREE USE.

As indicated in the following table, the amount and value of the National Forest timber taken without charge by settlers, miners, residents, and prospectors were somewhat greater than in 1914. In addition to the items shown in this table, considerable free-use timber was taken without permits from the National Forests in Alaska and from designated areas of dead material on National Forests in various Western States. Provision for free use of this character has been made where essential to meet the needs of local residents with dispatch and where the removal of the material in question will in no wise injure the forests. The removal of dead or fire-damaged timber is of benefit to the safety of the forests and is being encouraged by this means.

*Free-use permits, fiscal year 1915.*

State.	Number of permits.	Free-use timber cut.	
		Quantity.	Value.
		<i>Board feet.</i>	
Arizona.....	1,859	4,255,000	\$16,643.30
Arkansas.....	95	275,000	765.65
California.....	3,106	6,778,000	16,996.78
Colorado.....	3,742	10,587,000	15,344.26
Florida.....	41	33,000	74.65
Idaho.....	8,380	24,848,000	37,736.83
Michigan.....	32	109,000	81.00
Minnesota.....	33	286,000	2,022.00
Montana.....	5,280	18,378,000	36,565.26
Nebraska.....	23	5,000	50.00
Nevada.....	591	1,959,000	4,566.88
New Mexico.....	2,918	13,131,000	22,938.49
North Carolina.....	1	2,000	2.00
North Dakota.....	174	98,000	185.62
Oklahoma.....	475	175,000	107.50
Oregon.....	2,656	12,122,000	13,342.12
South Dakota.....	1,255	4,350,000	6,326.43
Tennessee.....	4	9,000	4.50
Utah.....	6,505	13,969,000	17,473.37
Virginia.....	18	91,000	29.18
Washington.....	670	2,371,000	2,933.42
Wyoming.....	2,157	9,337,000	12,274.89
Total, 1915.....	40,015	123,168,000	206,464.13
Total, 1914.....	39,466	120,575,000	183,223.09

The value of the free-use timber cut combined with the excess value of the timber sold at cost over the amounts actually paid for it makes a total of about \$240,000 of timber value, which is in effect National Forest revenue made available by Congress for the benefit of certain classes of citizens.

## EXTENSION OF TIMBER ESTIMATES.

The mapping and estimating of timberlands in the National Forests was continued on a slightly reduced scale; 1,781,803 acres was estimated closely, and an additional 1,471,553 acres was covered by a rapid reconnaissance to secure preliminary data. Funds for esti-



mating are expended only on areas which will probably be in demand within a few years. The estimates and maps furnish the basis for the appraisals required by law before timber can be sold and for fixing the silvicultural and other provisions of the sale contracts.

During the year the terms of sale, including minimum prices, were fixed for eight large tracts, each containing over 30,000,000 feet of stumpage. At the close of the year applications for the purchase of three of these blocks had been received.

#### TIMBER TRESPASS.

The receipts for timber cut in trespass were \$7,284.17. Timber trespass on the National Forests is no longer important in amount or character. The incentive has been largely removed by the availability of National Forest stumpage under free use or reasonable terms of sale. New trespass cases are usually the result of unintentional error in regard to title or the location of boundaries.

#### TIMBER SETTLEMENT.

The receipts for timber cut in connection with the occupancy of National Forest land for rights of way and other special uses were \$3,180.89. During the preceding fiscal year \$39,927.11 was received from the same source.

#### PROTECTION.

The number of National Forest fires during the calendar year 1914 and their causes are shown in the following table:

Extent of fires and amount of damage.	Number of fires.	Per cent of total.	Causes of fires.	Number of fires.	Per cent of total.
Under $\frac{1}{2}$ acre.....	3,253	49.27	Railroads.....	1,110	16.80
Between $\frac{1}{2}$ and 10 acres.....	1,807	27.36	Lightning.....	2,032	30.77
10 acres and over; damage under \$100.....	988	14.96	Incendiarism.....	470	7.12
10 acres and over; damage \$100 to \$1,000.....	458	6.93	Brush burning.....	596	9.02
10 acres and over; damage over \$1,000.....	99	1.48	Campers.....	1,126	17.05
			Sawmills, donkey engines, etc.	89	1.35
			Unknown.....	831	12.58
			Miscellaneous.....	351	5.31
Total.....	6,605	100.00	Total.....	6,605	100.00

The season of 1914 was hot and dry, and before its close a condition of grave emergency existed. In the heavily timbered districts of the northern Rocky Mountains and Pacific slope the winter snows were much below normal. An early spring and an early drying out of the Forests followed. In western Montana and northern Idaho there were forest fires in considerable numbers by the end of May. They continued until October. In California, where the dry season is always long, the danger period opened in some portions five weeks earlier than usual, and at the end of November the danger in the southern part of the State was still great. Sustained periods of high temperature, recurring hard and steady winds, and in places unusually hot, dry nights made the Forests exceedingly inflammable and fire protection unusually difficult. Throughout a large part of the West the fire hazard was quite as great as in 1910, when the great fires swept northern Idaho and western Montana.

The number of fires, as reported above, exceeded by about 1,400, or nearly 27 per cent, the number in 1910. In Montana and Idaho alone the value of specific bodies of timber threatened by approximately 2,000 fires, which started and were put out, was over \$59,000,000. In Oregon and Washington 1,200 fires threatened upward of \$24,000,000 worth. These figures make no count of the value of nonmerchantable young timber and reproduction on about 5,000,000 acres of land, nor of several million dollars' worth of ranch and other private property endangered. It became imperative to put forth every effort to protect the public interests at stake. In doing this expenditures were incurred which made it necessary to appeal to Congress for a deficiency appropriation of \$349,243. In addition, funds which would normally have been used for improvement and other work were largely drawn upon. That the situation was met with success is indicated by the fact that the damage to timber was less than 4 per cent of that in 1910. The season definitely established that even under highly unfavorable conditions the damage can, given an efficient organization, preparedness, and adequate funds, be kept down to a small amount.

The timbered area burned over in the calendar year 1914 was 225,979 acres, and the open 153,686 acres. The loss in Government timber destroyed or damaged was 339,430,000 board feet, with an estimated value of \$307,303; the value of reproduction destroyed, \$192,408; and the forage loss \$2,803. The total sum expended for fire fighting, in addition to the salaries of the regular Forest force, was \$685,790.

The percentage of fires directly attributable to human agencies increased from 46 per cent in 1913 to 57 per cent in 1914. As use of the Forests becomes more general, the exposure from this cause necessarily tends to grow. While improved methods of detecting and putting out fires must be developed to protect the Forests adequately as human activities within them multiply, the development of methods which will prevent fires from starting is even more necessary. Of first importance is public education in care to avoid starting fires. In the case of residents and users with a property risk of their own or a pecuniary interest in the conservation of Forest resources, carefulness with fire is relatively easy to teach. But the irresponsible transient visitor is a formidable menace. This fact has made necessary, especially in the regions in which the fire hazard is greatest, a campaign of education directed at the general public. Instructive articles are published by the local newspapers, cards giving on one side the game laws and similar useful information and on the other concise rules for safely disposing of camp fires and the like are distributed to tourists and campers, and special signs of short and catchy wording are posted abundantly along lines of travel through the Forests. In addition, the local Forest officers lose no opportunity to impress personally the need of care upon both permanent and temporary occupants. It is believed that the essentials of fire prevention have now been instilled in the minds of most men who frequent the National Forests, but the insistent problem is how to make the man careful who knows the danger but throws his match away thoughtlessly. Valuable cooperation in this educational work is received from forestry and timber-protective associations in the West.

## REFORESTATION.

The reforestation of denuded lands within the National Forests is being systematized along the lines previously developed by experimentation. Extensive operations are being concentrated more and more upon the most favorable sites; where success is problematical, work is restricted to experiments on a very small scale. The major areas reforested are the recent burns in heavily timbered belts, such as white-pine burns in northern Idaho, yellow-pine burns in the Black Hills of South Dakota, spruce and lodgepole burns in the central Rocky Mountains, and Douglas-fir burns on the northern Pacific coast.

Direct seeding was continued this year on nearly as large a scale as in 1914, a total of 5,876 acres being sowed. This was desirable to complete projects which had been laid out and upon which previous work had been done, and to utilize the supplies of seed which had been obtained. Hereafter this work will be confined to a few areas on the Black Hills and elsewhere where the most successful results have been obtained. The area planted, 9,731 acres, fell short of expectations on account of losses of planting stock at several of the nurseries, due to delayed germination and severe weather conditions. The area planted annually will be kept normally at 14,000 or 15,000 acres.

The cost of the areas reforested averaged \$10 per acre for plantations and \$4.39 per acre for direct seeding. The cost of the plantations was increased somewhat by the reduced output of some nurseries. A total of 7,208,000 trees was planted, mainly Douglas fir, yellow pine, western white pine, Engelmann spruce, and other commercially important western conifers.\* Field seeding projects used 23,692 pounds of seed.

The principal expansion in reforestation work is in the National Forests of the Lake States, where excellent opportunities are offered for the restoration of denuded lands to timber production. It was decided to terminate nursery and planting operations on the Kansas National Forest, where very adverse climatic conditions make the cost of plantations unduly heavy. The results gained have been valuable as experiments, but do not justify the permanent continuance of the work. The Garden City Nursery has, therefore, been dismantled, and all operations will be terminated with the planting out of the last remaining stock. Favorable results continue to be obtained in sand-hill planting in western Nebraska. A new nursery is being established on the Niobrara division of the Nebraska National Forest to extend reforestation operations to that division, pursuant to a special provision of the appropriation act for 1915. This will mean a material enlargement in the reforestation work in western Nebraska by 1917 or 1918, along the lines which have been developed previously at Halsey.

The results of a small plantation of maritime pine, the leading tree for the production of naval stores in Europe, on sand barrens on the Florida National Forest have been so encouraging as to make it advisable to establish a plantation of 1,000 or 1,200 acres of this species in order to make a thorough test of its adaptability to soil and climatic conditions on sandy lands in the Southeastern States and of its suitability for the production of naval stores in this region.



The following amounts of seed were secured by collection and purchase:

*Tree seed collected and purchased.*

	Conifers.		Hardwoods.	
	Clean seed.	Average cost per pound.	Clean seed.	Average cost per pound.
Collected by the Forest Service:	<i>Pounds.</i>		<i>Pounds.</i>	
District 2.....	1,517.19	\$1.66	47.00	\$0.12
4.....	336.07	.66		
5.....	517.96	1.10		
6.....	173.00	4.20		
Total.....	2,544.22	1.61	47.00	.12
Native species purchased.....	372.63	2.28	26.20	.75
Exotic species purchased.....	<sup>1</sup> 2,037.50	.12	<sup>2</sup> 1.12	1.27
Grand total.....	4,954.40	1.05	74.32	.51

<sup>1</sup> 2,000 pounds of this was *Pinus maritima*, costing about \$0.11 a pound.

<sup>2</sup> Eucalyptus.

Aside from the large purchase of maritime pine for use in Florida, both collections and purchases are small in comparison with previous years. This is due to the fact that the major emphasis is being given to the growing of nursery stock, which requires comparatively small amounts of tree seed.

The reforestation work of the year, by States, is set forth in the following table:

*Planting and sowing, by States.*

State.	Area planted.	Area sowed.	Total.	State.	Area planted.	Area sowed.	Total.
	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>		<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>
Idaho.....	2,757.76	1,336.13	4,093.89	Minnesota.....	211.31	8.50	219.81
Oregon.....	2,275.88	500.00	2,775.88	Michigan.....	204.84		204.84
Montana.....	1,441.33	1,275.50	2,716.83	New Mexico.....	135.42	0.30	135.72
South Dakota.....	360.00	1,880.00	2,240.00	Florida.....	2.86	67.98	70.84
Colorado.....	769.23	772.65	1,541.88	California.....	40.80	22.49	63.29
Nebraska.....	728.09		728.09	Other States.....	15.55	10.10	25.65
Utah.....	543.79		543.79				
Washington.....	244.90	2.50	247.40	Total.....	9,731.76	5,876.15	15,607.91

The larger nurseries engaged in the production of planting stock and the young trees on hand July 1, 1915, were as follows:

*National Forest nurseries and stock on hand.*

Nursery.	Forest.	State.	Seedlings.	Transplants.	Total.
Beaver Creek.....	Wasatch.....	Utah.....	2,630,200	120,000	2,750,200
Boulder.....	Helena.....	Montana.....	203,000	129,000	332,000
Cass Lake.....	Minnesota.....	Minnesota.....	759,000	100,600	859,600
Cottonwood.....	Wasatch.....	Utah.....	3,270,000	515,700	3,785,700
East Tawas.....	Michigan.....	Michigan.....	232,000	30,580	262,580
Fort Bayard.....	Gila.....	New Mexico.....	213,700	97,600	311,300
Gallinas.....	Pecos.....	do.....	250,000	11,200	261,200
Bessey.....	Nebraska.....	Nebraska.....	4,840,800	1,833,000	6,673,800
Monument.....	Pike.....	Colorado.....	1,472,000	724,200	2,196,200
Pilgrim Creek.....	Shasta.....	California.....	289,000	173,800	462,800
Pocattello.....	Pocattello.....	Idaho.....	2,075,330		2,075,330
Savenac.....	Lolo.....	Montana.....	6,990,950	2,683,480	9,674,430
Wind River.....	Columbia.....	Washington.....	2,953,000	1,125,000	4,078,000
16 smaller nurseries.....			397,679	174,648	572,327
Total.....			26,576,659	7,718,808	34,295,467

The nursery and planting station at Halsey, Nebr., has been designated the Bessey Nursery in honor of the late Dr. C. E. Bessey, of the University of Nebraska, a leading American ecologist and for many years active in promoting reforestation in Nebraska.

With the new Niobrara Nursery completed, the nursery equipment of the National Forests will be ample for the present requirements. Barring exceptional losses, the nurseries have a normal yearly output of 10,000,000 to 12,000,000 plants. There were used in them last year 6,304 pounds of coniferous seed and 45 pounds of hardwood seed. The average cost of the seedlings grown was \$4.25 per thousand trees, and of the transplants, \$6.05.

#### FREE DISTRIBUTION OF PLANTING STOCK.

Under the act of March 4, 1911, 112,110 trees were distributed to 746 settlers in the Kinkaid district, Nebraska. It was necessary to reduce the distribution somewhat, on account of the requirements for planting on the Nebraska National Forest. The needs of settlers in the Kinkaid district, however, appear to have been satisfactorily met with the stock available. A study of the results of previous distributions indicates that these homestead plantings will be more successful if special pains are taken with a limited number of trees than if the work is attempted on too large a scale.

The results obtained from trees distributed in 1914 were reported by 411 settlers. These results indicate that 35 per cent of the plants have established themselves successfully. This is probably as large a measure of success as can be anticipated under the conditions obtaining as to soil, climate, and the experience of the settlers in work of this character.

#### RANGE MANAGEMENT.

The high prices for all meat products during the past few years, particularly beef products, have created a strong demand for range. On many Forests the carrying capacity of the cattle range has been almost reached. The conditions have been an incentive to stockmen to improve the grade of their stock and to adopt better methods of management. New regulations, designed to improve the grazing conditions, have been adopted by the Forest Service, many of them at the suggestion of stock associations and individuals. There has been an increased construction of drift fences to hold the different herds upon their respective ranges and to separate the different grades of stock in breeding. Much has also been done in the development of water and in other improvements to utilize new range. On the whole, marked progress has taken place in making the ranges more productive.

Weather conditions during the season of 1914 were very favorable to forage growth, except in the southern portion of Idaho, where a heavy frost early in June reduced the carrying capacity of some of the weed ranges as much as 40 per cent, and in northern Idaho and Montana, where no moisture fell after the middle of July, causing the springs and forage to dry up early and reducing the carrying capacity very much below normal. All stock was in good condition at the close of the season and, with an open winter and an adequate

supply of hay, no losses were sustained. The 1915 season was favorable for forage growth, notwithstanding the fact that there was a very light snowfall throughout Wyoming, Utah, and northern Colorado. This was supplemented by spring rains, which placed the range in excellent condition.

## PERMITS.

The number of grazing permits issued and the stock covered by these permits were as follows:

*Grazing permits issued and stock grazed, fiscal year 1915.*

State.	Cattle, horses, and hogs.				Sheep and goats.		
	Permits issued.	Cattle.	Horses.	Hogs.	Permits issued.	Sheep.	Goats.
Arizona.....	1,793	288,875	7,900	565	144	389,657	4,490
Arkansas.....	11	123	15				
California.....	2,694	176,616	10,383	1,644	317	390,926	6,644
Colorado.....	3,352	301,208	9,124		416	629,940	1,323
Florida.....	25	571		52	3	321	
Georgia.....	56	366	7	26	9	74	
Idaho.....	2,042	108,500	8,976	159	634	1,594,726	
Kansas.....	92	12,721	219		1	300	
Minnesota.....	1	35					
Montana.....	2,275	133,560	16,405		388	730,507	850
Nebraska.....	65	9,753	828				
Nevada.....	440	74,077	5,709		98	454,615	
New Mexico.....	1,800	101,293	4,873	183	534	405,280	37,839
North Carolina.....	83	719	18	81	24	226	
North Dakota.....	12	343	82				
Oklahoma.....	51	4,272	339				
Oregon.....	1,876	108,777	10,745	66	495	769,323	263
South Dakota.....	472	11,394	2,109				
Tennessee.....	20	272		10	4	41	
Utah.....	6,830	171,253	12,899	4	1,442	919,834	
Virginia.....	19	103	28				
Washington.....	435	15,977	1,256		158	238,824	
West Virginia.....	3	7			8	60	
Wyoming.....	1,194	106,506	5,018	2	294	707,622	
Total, 1915.....	25,641	1,627,321	96,933	2,792	4,969	7,232,276	51,409

A material increase took place in the number of permittees, particularly small owners. The number of cattle and horse permittees increased 7.9 per cent over 1914, but the number of sheep and goat permittees fell off 4.2 per cent. This was doubtless due largely to a shifting over from one class of stock to the other. The average number of cattle and horses per permit dropped from 68 to 56, and of sheep and goats from 1,469 to 1,465.

The total number of cattle grazed increased 118,682, while horses decreased 11,308 head, hogs 589 head, and sheep and goats 313,117 head. The reduction in number of horses is very significant in contrast with the increase of 10,322 head the previous year. It can only be accounted for by the demand for horses in foreign countries. The reduction in sheep and goats is undoubtedly due to a general tendency on the part of flockmasters to reduce their bands to the number for which they can provide winter range and feed; to settlement upon lands formerly used for sheep grazing; and to a tendency of the smaller permittees to transfer to the grazing of cattle.

There were also issued 1,685 free grazing permits, allowing the grazing of 70,637 cattle, 2,163 horses, 664 hogs, 415,932 sheep, and 1,504 goats, in exchange for the use by National Forest permittees of 2,727,808 acres of unfenced private lands within the Forests.



There were 61,448 head of cattle and horses and 3,626,821 head of sheep and goats driven across the Forests, a reduction of 12 per cent and 17 per cent, respectively. The crossing permits issued dropped from 2,385 to 1,867, or 21 per cent.

The receipts from grazing fees, \$1,124,677.44, was an increase of \$127,094.97 over 1914, due partly to the increase made in the fees charged for the grazing of cattle and horses and partly to the increased number of the former. Notwithstanding that 1,160,854 acres were eliminated from the Forests, including some of the best grazing lands, the ranges carried as much stock as heretofore. This was due partly to the development of new range, partly to improved methods of use. These improved methods have increased not only the carrying capacity of the range but also the weight of the stock. Further increase through improved methods of management may be expected to amount to 15 per cent.

The number of live-stock associations cooperating with the Forest Service at the end of the fiscal year was 226. This was an increase of 60, or 36 per cent. The desire on the part of the stockmen to be thus recognized by the Forest Service further emphasizes their general satisfaction with the grazing administration. Their cooperation has been very beneficial to the Service in working out many grazing problems, and has likewise been of material benefit to the live-stock industry.

#### FREE USE OF RANGE.

A very considerable amount of range that could be used for paid grazing is employed in various nonrevenue-producing ways for public and semipublic purposes. These include the free use of range allowed settlers, up to 10 head of domestic, milk, or work stock; free use by Indian stock; use as sources of water supply of towns and cities, with resultant prohibition or restriction of grazing; use as game preserves with restriction or prohibition of grazing to provide game animals with sufficient food supply; free use of areas set aside to enable campers and travelers to find grass for their animals while passing through the Forests; and free use by stock passing through on established driveways or special routes.

The following table shows the acreage of Forest lands thus used, and their revenue-producing capacity if they were used for paid grazing:

*Use of grazing lands in National Forests for nonrevenue-producing purposes, season of 1915.*

Form of use.	Acres.	Carrying capacity (cattle.) <sup>1</sup>	Revenue obtainable if grazed.
Grazing milk and work stock.....	2,664,027	124,899	\$59,491.32
Town and city watersheds.....	952,260	40,385	15,829.90
Game preserves.....	1,424,840	75,679	20,799.66
Tourist areas.....	282,612	21,009	7,885.05
Driveways.....	905,116	657,213	19,501.55
Total.....	6,228,855	919,185	123,507.48

<sup>1</sup> Sheep range figured on basis of 4 sheep as the equivalent of 1 cow.

## PROTECTION OF STOCK AGAINST SOURCES OF LOSS.

The following table shows, by States, the number of predatory animals killed by Forest officers during the fiscal year 1915, as compared with 1914:

*Predatory animals destroyed, fiscal years 1914 and 1915.*

State.	Bears.		Coyotes.		Mountain lions.		Lynxes.		Wildcats.		Wolves.		Wolf pups.		Total.	
	1914	1915	1914	1915	1914	1915	1914	1915	1914	1915	1914	1915	1914	1915	1914	1915
Alaska.....		1														1
Arizona.....	5	2	41	232	15	5	1		19	19	2	1			83	259
California.....	28	38	419	337		7		10	91	101	2	15		1	540	509
Colorado.....	14	21	373	404	2	2	7	6	33	51		2			429	486
Idaho.....	25	26	434	427	6	4	7	9	36	25	2	4		6	510	501
Kansas.....			7	16											7	16
Michigan.....	1														1	
Montana.....	29	25	123	97	1		2	1	4	6	34	6	5		198	135
Nebraska.....			4	7											4	7
Nevada.....			109	70					4	2					113	72
New Mexico.....	9	1	82	76	25	5	6		96	48	19	8	1		238	138
Oklahoma.....			21	6					13	13					34	19
Oregon.....	42	35	406	455	4	1	1	8	67	28	4	4			524	531
South Dakota.....			161	134				14	2	28	12	4	2		207	150
Utah.....	32	24	606	595	3		2	2	87	20		3			730	644
Washington.....	31	8	24	6	4	5	12		41	21					112	40
Wyoming.....	24	8	356	301			5	7	14	15	4	2	2	2	405	335
Total..	240	189	3,166	3,163	60	29	57	45	533	361	71	47	8	9	4,135	3,843

The animals reported destroyed in the above table were killed by Forest officers exclusively in connection with their other work. Many other predatory animals were destroyed through loaning traps and furnishing poison to settlers. Protection of National Forest stock against losses due to poisonous plants and contagious diseases was continued along the same lines as in the past. Data covering the losses suffered from all causes showed a total reported loss for the calendar year 1914 of 9,793 cattle, 961 horses, and 77,415 sheep. This represents a money loss to the stockmen of not less than \$600,000, as well as a sensible diminution of the possible meat supply derivable from the Forest ranges. Predatory animals were found to be the most serious source of loss.

## CLEARING RANGE OF RODENTS.

The work of eradicating range-destroying rodents is still being conducted by the Biological Survey, which treated 327,935 acres, with excellent results. In some cases the success was 75 per cent. It is estimated that there still remains 1,756,293 acres infested with prairie dogs, ground squirrels, and gophers within the National Forests, which at the present rate will be cleaned up within five years.

## RANGE RECONNAISSANCE.

Intensive grazing reconnaissance by special parties of trained men covered with field examinations 896,942 acres on the Caribou, Manti, Wallowa, and Trinity National Forests, and data for 1,023,476 acres covered in the 1914 field examinations were worked up. The total

acreage now covered by intensive reconnaissance is 6,460,572 acres. Reconnaissance by members of the local force was undertaken on 33 Forests. A total of 830,690 acres was thus examined and mapped during the year, making a grand total to date of approximately 1,850,000 acres. In addition, the entire Tonto Forest and a portion of the Prescott Forest were covered by extensive reconnaissance for the purpose of adjusting important administrative difficulties.

#### GAME PRESERVATION.

The number of game animals of all kinds within the Forests is rapidly increasing, due almost entirely to the protection afforded them by Forest officers and an increased desire on the part of the settler to comply with the State game laws. Owing to the location of the National Forests the habitat of a very large portion of the big game animals of the country is now within their borders. Wild life is essentially a forest product, and as such is properly an object of the forester's care. The various Western States have come to realize the value of their game animals and are making increased efforts to protect them. The Forest Service is cooperating in game protection under definitely agreed plans with the States of Arizona, New Mexico, California, Oregon, Idaho, Utah, Wyoming, Colorado, Montana, and South Dakota.

The Wyoming legislature, at its last session, increased the area of game preserves and changed the boundaries of several to make them more practicable. The California legislature established a number of game preserves, and the game department is seriously considering a further extension of their boundaries.

The Forest Service, in cooperation with the Biological Survey and local stockmen, transported during the past winter two carloads of elk from Gardner, Mont., to Colorado, one carload being liberated within the boundaries of the Rocky Mountain National Park and the other upon the Sopris National Forest. Reports on the various plants of elk within the National Forests made during the past few years by the Forest Service and the Biological Survey indicate that the work has been very successful, and each herd is showing a big increase.

The buffalo herd upon the Wichita National Forest showed an increase of 12 head during the past year, and the herd now numbers 60. There is also a good increase in the elk herd within this preserve.

#### USE OF THE FORESTS FOR WATER-POWER DEVELOPMENT.

Twelve new power projects began operation under permit on the National Forests, with an output capacity at minimum stream discharge of 75,000 horsepower. This is an increase for the year of about 28 per cent. The total amount under both preliminary and final permit increased 94,000 horsepower, or 9 per cent; while 26 projects, with an output capacity of 96,000 horsepower, were in process of construction.

Rentals paid during the year for the use of National Forest lands for power purposes amounted to \$89,000.

New legislation permitting the Government to grant a more secure tenure for the lands used, through the issuance of 50-year leases, would, without doubt, make the financing of power developments



on the public lands both easier and cheaper, and is very desirable; but the main obstacle to more rapid development than that which is now taking place is not lack of a new law but lack of a broader market for power. It is at least doubtful if either an amended law or private ownership of the public power sites would result in any general or material increase in power development in the Western States in the immediate future. With rare and minor exceptions, existing power developments in these States are far in excess of market demands. The Forest Service is being constantly importuned to extend periods of construction on power permits on the plea that there would be no market available for the power if the project were developed. The per capita use of water power in electrical development in the three Pacific and the eight Mountain States is far in excess of that in any other section of the United States, and more than five times the average for the United States, as a whole. The development in the Pacific States is about 180 horsepower per thousand of population, and in the Mountain States 120 horsepower, with a balanced average of 160 horsepower. New England, which is next in order, has less than 40 horsepower per thousand of population, and the whole United States about 30 horsepower.

The following table gives the number and classification of permits outstanding and the estimated average output in horsepower at minimum stream discharge:

*Water power on the National Forests, June 30, 1915.*

Permits.	Transmission lines only.	Power projects, reservoirs, conduits, and power houses.	Estimated average output at minimum stream discharge.
Permits in force on June 30, 1915:			
Rental permits—			
Preliminary.....		19	462,039
Final.....	92	90	728,893
Free permits.....	16	73	70,628
Total.....	108	182	1,261,560
Constructed or operating on June 30, 1915:			
Rental permits.....	84	60	335,435
Free permits.....	13	48	5,841
Total.....	97	108	341,276
Under construction June 30, 1915:			
Rental permits.....	1	15	94,313
Free permits.....		11	1,326
Total.....	1	26	95,639
Construction not started on June 30, 1915:			
Rental permits.....	7	34	761,184
Free permits.....	3	14	63,461
Total.....	10	48	824,645
Applications received July 1, 1914, to June 30, 1915:			
Rental permits—			
Preliminary.....		21	
Final.....	18	13	
Free permits.....	2	13	
Total.....	20	47	

## OTHER SPECIAL USES.

Permits for the occupancy of National Forest lands for other than water-power uses issued during the year numbered 5,597, of which 2,674 were free. At the close of the year 7,694 pay and 10,374 free permits were in force. The area covered by those issued during the year was 272,372 acres, and by those in force at the year's close 1,087,623 acres.

## IMPROVEMENTS.

The construction and maintenance of improvements on the National Forests were conducted with an appropriation of \$400,000, supplemented by the incidental contribution of the time of Forest officers. This contribution, however, was less than in former years because of the heavy demands imposed by a severe fire season. The projects completed during the year comprised 108 miles of road, 1,719 miles of trails, 2,287 miles of telephone lines, 166 miles of fire lines, 102 lookout structures, 35 bridges, 267 miles of fence, 696 dwellings, barns, and other structures, 23 corrals, and 202 water improvements. Cooperative projects carried on with funds, materials, and labor contributed jointly by the Forest Service and communities, associations, and individuals and included in the above figures consisted of 81 miles of road, 191 miles of trails, 113 miles of telephone lines, 31 miles of fire lines, 55 miles of fence, 26 bridges, 2 lookout structures, 5 corrals, and 27 water improvements.

Since taking charge of the National Forests the Forest Service has been steadily extending as rapidly as possible the lines of communication into hitherto inaccessible regions, both for the purpose of better fire protection and to open up the country. The great bulk of the funds expended on improvements has been devoted to new projects. The upkeep cost due to the destruction of telephone lines, buildings, etc., by fires, the washing out of roads, trails, and other means of communication by winter storms, and the like, to say nothings of ordinary wear and tear by use, now demands and will increasingly demand heavy allotments for maintenance. In National Forest District No. 1 it was necessary during the year to devote \$35,000 out of a total allotment for improvement purposes of \$86,000, or over 40 per cent, to the maintenance of existing improvements in usable condition.

The estimated value of all improvements on the National Forests at the close of the year was \$5,223,000, of which 66.1 per cent represents works of communication and protection.

## ROAD AND TRAIL BUILDING FOR LOCAL COMMUNITY DEVELOPMENT.

The regular improvement work, the primary object of which is the better equipment of the Forests for administrative purposes, is supplemented by road and trail construction in the interest of community development. The latter work is made possible by the provision of law which appropriated for this purpose 10 per cent of the

National Forest receipts fund. The expenditures from this source totaled \$195,990.18. The total construction was 134.32 miles of road and 13.63 miles of trails.

The road construction work was organized with the cooperation of the Office of Public Roads. In five of the seven National Forest districts highway engineers detailed from the Office of Public Roads assist in selecting, locating, and constructing the roads. Available funds were concentrated on a smaller number of projects, and a higher class of construction was secured.

Among the more noteworthy projects built during the year are the following: The Bitterroot-Big Hole Road in Montana, giving the Big Hole Basin and adjacent territory access to Missoula and the Bitterroot Valley by substituting for a nearly impassable road, with grades as high as 25 per cent, a well-drained road on a 6 per cent grade; the Troy-Libby Road, in western Montana, forming the closing link in a through route down the Kootenai Canyon from the upper Flathead Valley to Spokane and the Inland Empire territory; a unit of the Mackenzie Pass Road in Oregon, which will, when completed, furnish the main route across the Cascades from the upper Willamette Valley to eastern Oregon; and a unit of the road across Teton Pass on the Idaho-Wyoming line, which will furnish a freight route with easy grades between Jackson Hole and the upper Snake River Valley and the railroad at Victor, Idaho.

Large areas within the National Forests, as well as in adjacent territory, are without adequate means of communication. Such roads as exist are ordinarily imperfectly constructed, undrained, and have excessive grades. In many instances such roads are all that the local community can afford to build. The Forest Service is endeavoring to correct this condition as fast and as far as funds permit. The amount available from the 10 per cent fund of the past year for 28 States (including Alaska) was less than \$240,000. While much good can be done with this amount, it is insufficient even to keep pace with the annual increase in demands for roads made urgent by the increase in settlement. Large areas of timberland of potentially great value are standing unused, partly because of lack of demand, partly on account of lack of transportation. Some method should be found by which the community's interest in these potential values may serve as security for funds for road construction now.

#### SCHOOL, ROAD, AND TRAIL MONEY FOR STATES FROM RECEIPTS FUND.

Under existing law, besides the 10 per cent of the receipts which is made available for expenditure by the Secretary of Agriculture in building roads and trails for the benefit of the public, another 25 per cent of the receipts is paid over to the States by the Federal Government for the benefit of county schools and roads. The amounts available under both the 10 per cent and the 25 per cent clauses of the law during the fiscal year 1915 and the amounts that will be available during the current year from the receipts of that fiscal year are shown on the following page.



*Amounts available for States from Forest receipts.*

State.	School and road moneys paid to States, fiscal year 1915.	School and road moneys payable to States, fiscal year 1916.	Road and trail moneys expendable by Secretary of Agriculture, fiscal year 1915.	Road and trail moneys expendable by Secretary of Agriculture, fiscal year 1916
Alaska.....	\$14,092.09	\$11,165.75	\$5,876.83	\$4,466.30
Arizona.....	63,398.34	59,807.89	25,359.34	23,923.16
Arkansas.....	9,983.19	8,738.93	3,993.28	3,495.57
California.....	65,001.84	67,011.87	26,000.73	27,044.74
Colorado.....	56,340.42	59,218.00	22,536.17	23,687.44
Florida.....	3,959.41	2,336.77	1,583.76	934.71
Georgia.....	108.44	77.35	43.37	30.95
Idaho.....	59,227.81	75,651.15	23,691.12	30,260.46
Kansas.....	1,207.72	1,357.33	483.09	542.93
Michigan.....	78.68	198.37	31.47	79.35
Minnesota.....	538.72	1,971.60	215.49	788.64
Montana.....	93,586.06	79,589.78	37,434.42	31,835.91
Nebraska.....	1,064.38	1,401.15	425.75	560.46
Nevada.....	16,894.47	16,244.53	6,757.79	6,497.81
New Hampshire.....		137.09		54.83
New Mexico.....	33,743.49	31,786.46	13,497.40	12,714.58
North Carolina.....	206.31	401.41	82.52	160.48
North Dakota.....	74.83	81.83	29.93	32.73
Oklahoma.....	638.87	759.77	255.55	303.91
Oregon.....	61,606.50	49,675.83	24,642.60	19,870.33
Porto Rico.....		9.25		3.70
South Dakota.....	14,469.77	12,988.11	5,787.91	5,195.25
Tennessee.....	20.64	94.35	8.26	37.74
Utah.....	37,601.15	48,675.96	15,040.46	19,470.38
Virginia.....	613.00	282.47	245.20	112.99
Washington.....	35,637.50	37,445.56	14,255.02	14,978.23
West Virginia.....		1.91		.76
Wyoming.....	28,578.50	43,086.86	11,431.40	17,234.75
Total.....	599,272.17	610,797.75	239,708.06	244,319.10

The States of Arizona and New Mexico received additional shares of National Forest receipts for their school funds on account of school lands included within National Forests, as follows: To Arizona, paid in the fiscal year 1915 from the receipts of 1914, \$30,730.58, and payable from the receipts of 1915, \$28,966.46; to New Mexico, paid in the fiscal year 1915 from the receipts of 1914, \$9,890.94, and payable from the receipts of 1915, \$9,311.87.

## EXCHANGE OF LANDS.

The field work in connection with the consolidation of State lands within the National Forests of Montana was practically completed. There remains only the adjustment of the final details. The appropriation act of March 4, 1915, provided special funds for carrying on similar work in cooperation with the State of Washington. Plans were perfected to undertake this work as soon as the funds authorized under the law became available. It is regrettable that the exchange and consolidation of State lands agreed to with the States of South Dakota and Idaho are still held up, awaiting confirmatory legislation.

Under the provisions of the act of July 25, 1912, providing for land exchanges within the Paulina National Forest, an exchange of 25,988.16 acres with the Oregon Land Corporation was approved. The exchange consolidates Government holdings, and also the company's holdings, to the advantage of both. The land was carefully examined and the timber cruised and appraised, and the land and timber on both areas involved were found to be of substantially equal value.

The exchange of Government and private lands in the Sierra National Forest and Yosemite National Park, to protect the scenery in the park, as mentioned in the last annual report, was finally consummated by an agreement reached between the Secretary of Agriculture and the Secretary of the Interior upon one hand and the owners of timberland upon the other, executed January 23, 1915. By the terms of this agreement the timber owners transfer 4,505.35 acres to the Government and receive in return 4,000 acres of land from which the timber can be cut without affecting public scenic values. The exchange of lands authorized by the act of May 13, 1914, mentioned in my last report, was consummated during the past fiscal year, and final patent issued June 7, 1915. It was not found possible to effect any exchanges under the act of June 24, 1914, authorizing such exchanges in the Ochoco National Forest of Oregon, owing to the difficulty of effecting exchanges of small areas with the requirement that the lands must be equal in both area and value.

#### ACQUISITION OF LANDS.

On recommendation of the Forest Service, the National Forest Reservation Commission approved for purchase during the year under the act of March 1, 1911, 282,900 acres in the Southern Appalachians and White Mountains. The total approved is now 1,317,551 acres, of which 348,275.66 acres have been acquired and paid for. On 196,629 acres condemnation proceedings are pending. The remainder awaits the completion of survey or title examination. These lands are being placed under administration and their resources developed as rapidly as they are acquired.

#### COOPERATION WITH STATES.

Protection from forest fires in cooperation with the States, under section 2 of the Weeks law, was continued during the year by virtue of a Federal appropriation of \$100,000. This protection is confined to State and private lands on the forested watersheds of navigable streams. To the 18 States with which the Government cooperated in 1913 were added Virginia and North Carolina, which established protective systems during the year and qualified for assistance under the terms of the act.

Federal allotments are made to the several States so as to accomplish the most effective results in the safety of important watersheds and the education of the public as to the value and practicability of forest-fire protection. Prior to 1915 the maximum annual allotment to any State was \$10,000. The inclusion of a larger number of States has now made it necessary to reduce the maximum allotment to \$8,000. A contingent is retained to meet urgent conditions occasioned by serious fires in any State which may thus require special assistance.

The Government funds are used almost exclusively for the employment of lookout watchmen on mountain stations, or of patrols. Approximately 300 Federal employees are maintained in the field during the fire season, guarding an area of about 13,000,000 acres. The average cost of this protection is about three-fourths of a cent an acre. The Federal expenditures, however, are less than one-fifth of those of the States, while the funds spent by private owners, including some 40 timber protective associations, probably equal the Federal and State expenditures combined.

To facilitate the protective organization in the States during the summer fire season, Federal allotments are made by calendar years. The allotments for the calendar year 1915 and expenditures for the fiscal year ended June 30, 1915, in each of the cooperating States, are shown in the following table:

*Allotments and expenditures for fire protection in cooperation with States.*

State.	Allotments, calendar year 1915.	Expenditures, fiscal year 1915.	State.	Allotments, calendar year 1915.	Expenditures, fiscal year 1915.
Maine.....	\$8,000.00	\$6,444.00	Wisconsin.....	\$4,500.00	\$1,779.00
New Hampshire.....	6,500.00	6,680.00	Minnesota.....	8,000.00	4,968.00
Vermont.....	2,500.00	2,448.59	South Dakota.....	450.00	296.00
Massachusetts.....	2,500.00	1,708.00	Montana.....	3,500.00	2,172.91
Connecticut.....	2,000.00	822.50	Idaho.....	5,500.00	5,171.53
New York.....	8,000.00	5,712.12	Washington.....	8,000.00	7,145.75
New Jersey.....	2,000.00	2,123.00	Oregon.....	8,000.00	9,940.75
Maryland.....	2,000.00	1,854.90	Administration.....	3,200.00	.....
West Virginia.....	4,500.00	4,328.25	Inspection.....	2,350.00	1,200.51
Virginia.....	2,000.00	1.00	Unallotted balance.....	6,000.00	.....
Kentucky.....	4,000.00	3,156.00			
North Carolina.....	2,000.00	.50			
Michigan.....	4,500.00	1,570.14	Total.....	100,000.00	69,523.45

The cost of efficient protection is necessarily large. While the funds appropriated under the Weeks law actually furnish but a small part of the protection afforded, forest lands on the watersheds of navigable streams, they have given a great stimulus to the protective movement throughout the entire country. They have brought the various agencies, Federal, State, and private, into close relationship and thus welded the more or less scattered and unrelated protective efforts into an organized, efficient system. In this lies the most important result of the cooperative work. Nevertheless, the solution of the national problem of protection from forest fires requires the continued participation of the Federal Government. The enormous public interests involved in the protection of forest and water resources will not justify withdrawal. Preserving the navigability of important streams through the protection of their watersheds is now recognized as a duty of the Federal Government and justifies the assumption of a definite part of the cost. Greatly enlarged appropriations are unnecessary; but it should be the policy of the Government to continue this work permanently as an active associate of the State and private owners.

A brief survey was made of the forest conditions in Texas at the request of State authorities. The report to the State recommended a forestry law providing for a nonpartisan department of forestry, a State Forester of technical training, a forest fire protective system, cooperation with towns and citizens in preparing plans for the management of woodlands, and the development of State forests by gift or purchase, including nurseries for the production and distribution of young trees at cost. These recommendations were subsequently enacted by the State legislature. Assistance in drafting bills and formulating forest policies was also extended, upon request of the State, to Alabama, California, Florida, Georgia, Michigan, Montana, New York, North Carolina, Oregon, West Virginia, and Wisconsin.



The publication of a compilation of State laws dealing with forestry in all of its phases was begun. Many requests for information regarding such laws have been received from State legislatures and administrative officers, forestry associations, forest schools, and others interested in practical forest conservation. The compilation of State legislation on these subjects will aid materially in developing the principles of State forest laws and indicating the forms of legislation which are most successful in various fields of State forest work.

### RESEARCH.

On June 1, 1915, the lines of investigative work were brought under one direction by the establishment of the Branch of Research. During the previous three years the various studies and investigations were correlated by means of investigative committees, but the establishment of a separate branch was deemed advisable to make such correlation more complete and at the same time to segregate investigative work from administrative work in accordance with the policy established for the department. It was further the purpose of this change to give the research work and personnel fullest recognition and to develop and strengthen research as a coordinate division of the Service. The Service activities transferred, with the organizations necessary to conduct them, were: Silvicultural investigations, including the Office of Forest Investigations in Washington and the direction through the District organization of the experiment stations; investigations of forest products, including the Forest Products Laboratory at Madison, the Office of Industrial Investigations in Washington, and through the District organization the Offices of Forest Products in the Districts; economic studies of the lumber and other wood-using industries and studies of methods, cost, and efficiency; fire protective studies; and statistical investigations.

### NATIONAL FOREST INVESTIGATIONS.

Most of the investigations and experimental work conducted on the National Forests have been concentrated at or carried on under the direction of the eight experiment stations now in existence. The practical value of these stations for solving problems which require painstaking care has been fully demonstrated. As the work becomes more thorough and problems more complex, field examinations can no longer supply all the information wanted for investigative projects. The general scope of the forest investigations followed practically the same lines as in 1914, the relative importance of various lines being only slightly changed by a decrease in reforestation experiments.

Continued studies in artificial methods of seed extraction established that when lodgepole pine cones are stored for one year it is possible to obtain one-half of the seed by air drying alone and the remainder with about one-third of the heat required when the cones are green. The tests with lodgepole pine have tended to reemphasize the importance of collecting seed near where it is to be used. The study of the effect of the source of Douglas fir seed upon the stock produced brought out that the collecting of cones should be confined to a locality as cold as or colder than the proposed planting site; that cones should not be collected from trees growing in shallow, gravelly,

or otherwise poor soil; that open-grown trees produce larger crops of cones, larger yields of good seed per bushel of cones, and larger 2-year-old seedlings than do forest-grown trees.

The numerous experiments with methods and seasons for reforestation have, without exception, added evidence to the advisability of planting nursery stock. As to the kind of stock to use, experimental results secured from planting seedling stock on the west slope of the Cascades, where favorable moisture conditions prevail, have brought out facts which may have a far-reaching effect in the Pacific Northwest. They indicate that western white-pine and yellow-pine seedling stock, as a whole, survive better than transplant stock. With western larch stock a larger number of transplants than of seedlings survived, yet the cost for each surviving tree was lower for seedlings than for transplants. Approximately 6,000 acres of old plantations in the Pacific Northwest were examined to ascertain, as a guide for future planting in the region, what methods, sites, character of stock, and seasons of planting have given the best results. A continued study of old burns of Douglas fir west of the Cascades to discover under what conditions natural reproduction takes place showed that when a mature stand of timber is burned a stand of young growth springs up from the seed stored in the litter and duff, unless the fire is so severe that the litter and duff are consumed; that a young seed-bearing stand produces a more scattering stand of young growth following a fire, due to less litter and duff and less seed on the ground; that white pine follows repeated burns better than other species because its seed remains fertile in the ground longer and because it begins to bear seed at a much younger age than such associates as hemlock, Douglas fir, and cedar; that a burned forest is normally followed by the same species that made up the original forest, but with a varying representation, determined by the seeding conditions before the fire; that exposed dry slopes are always partially or entirely denuded as a result both of the drier conditions at the time of the fire and of the loss of seedlings after germination by drought; and that germination is greatest the first year after the fire, but scattering germination takes place for several years. Study of the effect of forest cover upon streamflow and erosion at the Wagon Wheel Gap Experiment Station was continued. In the study of the climatic characteristics of forest types numerous observations were conducted in Colorado, California, Idaho, and elsewhere. The extension of snow-scale observations to all Wyoming Forests, in cooperation with the Weather Bureau, will materially help this study.

Investigations in seeding ranges to cultivated forage plants were limited, as in the previous year, to intensive experiments with hardy varieties of Russian alfalfas and with some 25 species of native range plants. The object is to find, if possible, some valuable forage plant which will thrive where climatic and soil conditions are not favorable to the present species. A small amount of time was devoted to a continuation of the studies with cultivated species under open range conditions.

Deferred and rotation grazing investigations were continued at the Utah Experiment Station, on the Eldorado and Coconino Forests, and to a minor extent in many places elsewhere. The fundamental principles are that revegetation is helped by grazing after seed maturity, but continued grazing prior to seed maturity weakens the



vegetation and gradually depletes the range. Results under practical application have convinced both Forest officers and permittees wherever the system has been practiced that it is to the advantage of both range and stock.

Five years ago most Forest officers were unable to identify the various plants making up the forage crop. This made it difficult to secure use of each range by the class of stock to which it was best suited, to apply deferred and rotation grazing, and to eliminate losses from poisonous plants. This obstacle to efficient range management has been overcome by a system of plant collection and identification. Some 23,000 specimens of 3,000 different species have been collected on various National Forests, identified by specialists, and the collector informed as to the value of each. Last year about 5,000 specimens were collected. The majority of the National Forests upon which grazing is important now have collections of important forage and poisonous plants, and the information is being extended to the range users—an essential if improved management is to be quickly introduced. Both Forest officers and permittees see the value of the work.

The studies on the Coconino, Payette, and Shasta Forests to determine the effect of grazing upon reproduction of conifer forests were continued, and plans of grazing management to secure the maximum use of all resources were worked out and are now being applied, especially in the yellow-pine forests. The management of grazing on aspen lands was studied on the Manti Forest. The studies initiated in 1912 to work out grazing management of Alpine land subject to erosion and floods were continued. They have shown that the management of sheep grazing on these lands is a problem of no small importance. Experiments in checking erosion and improving mountain meadows by damming gulleys and diverting small streams so as to distribute the water indicate a possibility of checking serious meadow erosion and improving the forage crop.

Adoption by stockmen of the bedding-out system of handling sheep was furthered through demonstration tests and other educational work among permittees. As nearly as can be estimated, approximately 50 per cent of the sheep on the National Forest summer ranges are now handled under this system. The gain in weight and selling price of lambs thus handled have substantiated the experimental results and aided materially in extending the system.

Results of the experiments to determine the practicability of small coyote-proof inclosures and sheds in connection with range lambing now justify the belief that 7 per cent is a conservative estimate of the increase in lamb crop which can be saved in this way. This more than justifies the outlay required. The plan has been adopted by a number of sheepmen in New Mexico.

In the last half of the fiscal year the Jornada and Santa Rita Range Reserves, located in New Mexico and Arizona, were transferred from the Bureau of Plant Industry to the Forest Service. These reserves were established to provide for the better study of grazing problems. Investigations on an enlarged scale relating to methods of handling and feeding range cattle are under way. Study of the carrying capacity of the National Forest ranges secured results of marked value for the development of intensive grazing management.



Cooperation with the Bureau of Plant Industry in the study of poisonous plants and means of reducing losses from them was continued at the field station near Graycliff, Mont., and on various Forests. Special attention was given to further work on death camas and the lupines. It was definitely determined that death camas is responsible for a great deal of loss from previously undetermined causes among sheep throughout the Northwest and on the high summer ranges of the Utah Forests. It was established, also, that lupine is the cause of a great deal of loss among sheep, and that it is probably the cause of some loss heretofore unaccounted for among horses. A good supply of forage, and quiet, open handling of all stock are found of the first importance in eliminating loss. In addition to the work on death camas and lupine, important work was carried on with wild cherry, loco, sorghum, and to a small extent with the laurels. It is now certain that all species of *Zygadenus* except *Zygadenus coloradensis* are poisonous, and that all species of larkspur are poisonous to cattle. Additional work will be necessary on various species of lupine hitherto not studied. Work on loco has been undertaken on comparatively few of the many species. Minor investigations on the southwestern Forests suggest that species hitherto little known as poisonous plants are probably responsible for losses of stock on these Forests. In the latter part of the year this work was transferred to the Bureau of Animal Industry. The Forest Service cooperated with this bureau in selecting and establishing a new field station for poisonous-plant investigations on the Fishlake Forest, in Utah, which will be used as a base of field operations in place of the Graycliff Station. Henceforth the Forest Service will receive from the Bureau of Animal Industry information as to the kinds of plants found to be poisonous to different classes of stock and will then undertake to learn the distribution of each species throughout the National Forests and to work out methods of protection. This problem has already been undertaken aggressively. The main effort has been concentrated upon determining the practicability of eradicating larkspur, both by grubbing it out and by sheep grazing. A demonstration test to determine beyond doubt the practicability of eradicating the larkspur is under way now on a complete community cattle allotment on the Stanislaus Forest. Results secured by grazing larkspur areas with sheep before cattle are turned on are very promising.

#### OTHER INVESTIGATIONS.

##### SILVICULTURAL AND DENDROLOGICAL STUDIES.

In tree studies work on seven species was completed. Continued study of the woodlot problem, with particular reference to the marketing of woodlot products, secured a large volume of data valuable both for publications on woodlot handling and for demonstration work in cooperation with State agricultural colleges. An economic survey of the farm woodlots in the eastern United States was undertaken in cooperation with the Office of Farm Management. Its aim is to determine the economic value of the woodlot in the general scheme of management adapted to the farm and to the particular locality.

Approximately 3,500 basket willow cuttings were distributed to the State experiment stations, 400 to forest schools, and 14,900 to

individuals. One thousand and ninety-three field measurements were collected and worked up into 20 volume tables and 38 miscellaneous tables. Eighteen hundred new range records were added to the forest distribution files, and nearly 650 specimens of native and exotic species were identified. A preliminary report on the shrubs of the genus *Ceanothus* and a publication on junipers and cedars of the Rocky Mountains were completed.

#### STUDIES OF FOREST PRODUCTS.

**STUDY OF THE LUMBER INDUSTRY.**—Conservation of the forest resources of the United States is linked inseparably with the economic conditions controlling the exploitation and marketing of forest products. The duties placed upon the Forest Service by law require an understanding of conditions in the forest-using industries in two important particulars, namely, promoting the practice of forestry and the wise use of all forest resources and disposing intelligently of the timber on the National Forests.

During the past five years unstable and more or less destructive tendencies in the lumber industry have become apparent. They have been reflected not only in an uncertain and haphazard demand for National Forest stumpage but also in overproduction of forest products, actual or threatened, in fluctuating market values, and in increasing rather than diminishing waste of raw material in the process of manufacture. At the same time the belief has been widespread that lumber costs the consumer too much.

The prevalence of these upsetting conditions in nearly all of the principal lumber-producing regions led to a proposal in June, 1914, that a joint study of the situation be made by all of the Federal agencies concerned. This was arranged in cooperation with the Bureau of Corporations and the Bureau of Foreign and Domestic Commerce. During the progress of the study the Federal Trade Commission took over the work of the Bureau of Corporations, and the cooperation begun with that bureau has been continued with the commission. The purpose is to determine the important facts regarding the ownership of timber, the manufacture of lumber, and its distribution to the consumer. The cost of every step from the purchase of standing trees to the delivery of finished boards, the market value of lumber in different periods and the returns realized by producers, tendencies toward overproduction, the effect of conditions in the industry upon the economical use and renewal of its raw material, the relation of the public timber to the utilization of private holdings, and the bearing of all these factors upon the policy followed in selling National Forest stumpage are receiving careful consideration. Technical studies have also been undertaken to show how more profitable utilization of timber and better methods of manufacturing and grading in relation to specific uses may be brought about.

The primary object of this inquiry is to give the Government and the public an understanding of the actual conditions in this great industry and their effect upon practical forest conservation in the United States, to the end that, if possible, constructive proposals may be offered for protecting the interests of the public in an assured future supply of timber available at a reasonable price. The study should also disclose how more stable and healthy conditions can be secured in the forest-using industries. The governing consideration

must of course be the advancement of the public welfare. It is believed that this may be best served by working out, in a spirit of fairness and helpfulness, a more fully developed national policy for dealing with forest resources. This should prove of advantage to the consumer and the manufacturer alike.

**UTILIZATION OF NATIONAL FOREST TIMBER.**—In the forest products investigations problems affecting the administration of the National Forests were given first place. Some of the more important investigations and results were the development of a method of refining heptane from digger pine and cooperation with the Bureau of Standards to establish the use of this material in the standardization of candlepowers; the further development of methods of drying western larch; the development of greatly improved methods for drying white fir; the determination of the cause for collapse in kiln drying western red cedar and the partial development of a remedy; researches to determine the cause of brown stain in sugar pine, which often depreciates the value of the lumber by more than \$10 per thousand; the collection of material and its preparation for publication showing the value of the National Forests as a source of tie material and pulp wood; a special examination of the National Forests in Alaska to determine their pulp possibilities; promising results in the development of a method for creosoting Douglas fir which will not decrease the strength of the material; the manufacture of an excellent kraft paper from Douglas-fir mill waste; in cooperation with the Geological Survey, attempts to locate deposits of basaltic rock suitable for the manufacture of pulp stones, now imported at heavy expense from Europe; and the completion of nearly 13,000 tests on 19 different species of National Forest timbers.

Studies of lumbering methods and costs, as well as mill scale and depreciation studies, were continued in the districts on a more intensive basis. These studies have already furnished data of great value for appraisals of National Forest timber and also have made possible increased operating efficiency in the lumber industry.

**ASSISTANCE TO FEDERAL DEPARTMENTS.**—Aid to other departments through expert advice was more extensively given than ever before. It included the preparation of planting plans and the direction of field planting; the examination of timberlands, timber appraisals, and the preparation of plans for conservative management; the preparation and revision of specifications for Government purchases of wood and wood products; inspection and check inspection of such purchases; the determination of mechanical and chemical properties of wood; analyses of wood preservatives; the preservation of piling and other wood products; methods of storing and handling lumber; and the market value of timber. It has been given the Panama Canal, the Interstate Commerce Commission, the Reclamation Service, the Bureau of Fisheries, the Bureau of Chemistry, the Office of Public Roads, the Bureau of Plant Industry, and both the War and Navy Departments.

**FOREST PRODUCTS LABORATORY.**—A growing interest in the work of the Forest Products Laboratory was manifested. About 3,000 lumbermen, engineers, chemists, foresters, and others, including visitors from Canada, Holland, Germany, Chile, Portugal, Japan, the Philippine Islands, Mexico, and England, visited it. For the first time it



became the meeting place of engineers and lumbermen's associations. At the request of the Canadian and Tasmanian Governments, experts from the staff were furloughed to assist in drafting a policy for utilizing the forest resources of British Columbia and to study the pulp and paper possibilities of Tasmania. Investigations of the paper possibilities of several Chilean woods were made and similar tests for the Argentine Government arranged.

Close relationship was maintained with the various wood-using industries, to the end that their problems may be clearly recognized, and with individuals, companies, trade and other associations, and technical societies interested in the use of wood and wood products, that cooperation may be secured for demonstrating laboratory results on a commercial scale. Service tests on the relative durability of treated and untreated timbers were conducted in cooperation with 65 railroads, mining companies, municipalities, agricultural colleges, etc. Cooperation on preservative paints and fireproofing compounds involved 36 companies. Demonstration on a commercial scale of laboratory results involved 11 cooperators.

The strength tests of timber which have been continued for several years have shown conclusively the need for grading rules for structural timbers which will give an indication of strength. A method of judging the strength of southern pines from the proportion of summer wood in annual rings was developed, and this factor, in combination with defects limiting strength, was used in formulating grading rules which have been adopted by the American Society for Testing Materials, the Southern Pine Association, and the National Board of Fire Underwriters. Efforts are now being made to work out similar rules for Douglas fir, and, in cooperation with various agencies, to devise methods for testing boxes and similar packages.

The investigations of derived products were mainly the search for improved methods of manufacture to increase yields. Temperature control in hardwood distillation on a commercial scale increased the value of yields \$335 per month in a 50-cord-per-day plant and the methods developed are now being followed. An increase of 20 minutes in the time of digestion of sawdust increased the yield of ethyl alcohol by 23 per cent, and the present status of investigations indicates that western larch may be valuable as a source of alcohol. Improved methods of turpentinizing demonstrated by laboratory experts have been adopted by one of the largest operators in the South. Chemical analysis of the total cellulose contents of woods shows the possibility of increasing pulp yields by improved methods from 5 to 20 per cent. Laboratory methods have shown the value of Osage orange as a dyewood and substitute for materials not now available for import sufficiently to justify its trial on a commercial scale.

The work in wood preservation covered three principal lines: Attempts to improve methods of preservative treatment, to prevent or reduce losses from sap stain, and to improve methods of fireproofing. In cooperation with the Bureau of Fisheries considerable progress was made in the determination of what substances are most effective in preserving piling from attacks of teredo and other marine borers. It was found that creosote can be used in silos without contaminating the silage. Methods were developed for treating wood blocks which will largely or altogether prevent swelling and

bleeding, the chief causes for dissatisfaction with wood paving hitherto. Inspections of experiments installed during past years made possible the preparation of the most exhaustive record ever compiled on the durability of various species of timber treated under various methods with different preservative compounds.

The discovery that sodium fluoride is superior to sodium carbonate in preventing sap stain promises to reduce materially the present estimated annual loss of \$7,000,000 from this cause. A fire-testing house constructed during the year duplicating conditions in modern office buildings will permit future tests of great practical value in the fireproofing of wood finish. Other tests on fireproofing compounds have given a much more exact measure than has ever before been available of the comparative value of the compounds in the market, and have further resulted in the development of a new compound by the laboratory staff which will be patented and dedicated to the public.

About 70 species of hardwoods and 40 species of conifers were tested to show their relative resistance to decay, and about 900 tests were made on the toxic properties of wood preservatives.

In timber physics the most important work of the year was the further development of methods of kiln drying originally devised by the laboratory staff and the working out of variations adapted to different species, together with the cooperative demonstration of these methods on a commercial scale. The Service method is based upon full control of temperature, moisture, and circulation during the period of drying. Dipping in paraffin was shown to reduce materially the tendency of wood to shrink and swell.

Improved methods for the manufacture of ground-wood, soda, and sulphate pulps showed the possibility of increasing yields 20 per cent under the former and 5 per cent under each of the latter processes, while other methods were worked out for eliminating the "fuzziness" from soda pulp. For the first time methods were developed for making a good kraft paper from longleaf pine stumps from which the turpentine and rosin had previously been extracted.

#### INDUSTRIAL INVESTIGATIONS.

The collection of statistical data on various forest products was continued. In general, the year was one of overproduction and slack business in the principal lumber manufacturing regions. A report on the amount of wood preservatives used and the amount of timber treated in the United States showed a considerable falling off in the use of the principal preservative (creosote) in 1914 as compared with 1913, due probably to conditions induced by the European war.

Reports on the wood-using industries of three States were published. Thirty-three State reports of this character have now been issued. A final report on the wood-using industries of the United States is in preparation, in which the data collected in the various studies will appear by species and by industries.

Records of lumber prices for important woods, useful in establishing timber-sale prices and in answering inquiries as to the range of price of certain kinds and grades of lumber, were compiled quarterly.

A wood-waste exchange was established, to bring together manufacturers of wood products who had waste to dispose of and manu-

facturers of wood products who use comparatively small pieces as their raw material, and met with hearty cooperation from manufacturers. A field study of southern pine in the Southeast, to determine the quality of wood grown in the various parts of the Southeast and the quality of lumber in typical markets in the East and Middle West, secured data of immediate practical value to a number of associations and engineering societies in formulating more satisfactory grading rules. A preliminary report on the box industry furnished information of considerable use in recent investigations of shipping containers by other departments of the Government.

#### MISCELLANEOUS.

Twenty-seven new publications were issued. In all, 388,000 copies of Forest Service publications were distributed. The total number of books and pamphlets in the library was increased to 18,245; 1,072 new ones were added, and 560 which were either duplicates or out of date were eliminated. To the libraries maintained in district and supervisors' offices and the Forest Products Laboratory were added 1,266 books and pamphlets, bringing the total number in these libraries to 29,814.

Members of the Forest Service delivered 149 public addresses, mainly in response to requests from educational institutions, associations of lumbermen, technical societies, and National Forest users.

Exhibits consisting of bromide enlargements, transparencies, maps, models, specimens, and charts were made at the Western Pennsylvania Exposition, Pittsburgh, Pa.; the Boston Pure Food and Domestic Science Exposition, Boston, Mass.; the demonstration train of the Kentucky State Experiment Stations, Kentucky; the Seaside Exposition, Asbury Park, N. J.; Vermont agricultural fairs; the New York State Fair, Syracuse, N. Y.; the Kentucky State Fair, Louisville, Ky.; Master House Painters and Decorators' Association, Washington, D. C.; the Arkansas Press Association, Harrison, Ark.; Ninth Dry Farming Exposition, Wichita, Kans.; Panama-California Exposition, San Diego, Cal.; and the Panama-Pacific International Exposition, San Francisco, Cal. In connection with the exhibit at the Panama-Pacific International Exposition 223 lectures were delivered and a series of motion pictures of an educational nature shown daily. For three of the expositions an appropriation was made by Congress; in the case of the others the expenses involved in making the exhibits were borne by the exposition authorities.





## REPORT OF THE CHEMIST.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF CHEMISTRY,  
*Washington, D. C., October 1, 1915.*

SIR: I submit herewith the report of the work of the Bureau of Chemistry for the fiscal year ended June 30, 1915.

Respectfully,

CARL L. ALSBERG,  
*Chief of Bureau.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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New investigations in connection with the application of chemistry to agriculture and the development of a systematic plan of inspection in connection with the enforcement of the Federal food and drugs act increased very largely the volume of work done by the Bureau of Chemistry during the fiscal year.

The research work, which has heretofore been confined largely to problems arising in connection with law enforcement, was extended to include work designed to prevent spoilage and waste and to increase production.

The experience of the bureau in the administration of the Federal food and drugs act shows that violations of its provisions are quite as frequently the result of ignorance of proper methods of production as of willful intent. The effort which has been made to improve old and devise new methods of production has proved to be an important factor in securing compliance with the law. The results obtained have been communicated to manufacturers and producers through cooperative experiments and publications.

The research work has been divided so as to segregate investigations in reference to food adulteration from investigations of new methods of production and new methods of utilizing products of the soil and sea. In both, there has been increased activity, and it is contemplated that in the near future research work in agricultural chemistry, which in recent years has been overshadowed by the demands of regulatory work, will take an equally important place in the duties of the bureau.

### RESEARCH.

FLORA OF FOODSTUFFS.—A laboratory of microbiology was established for the purpose of further developing work upon the decomposition and fermentation of food products. In this laboratory a comparative study was undertaken of the groups of species of molds.

their natural or usual habitats, and the changes induced by them in foodstuffs. With this was combined a study of related forms. The results of the study of the *Penicillium luteum purpurogenum* group have been published. A study of corn silage and corn meal was begun. This work supplements work previously completed and published in Department Bulletin No. 215, "Composition of Corn (Maize) Meal Manufactured by Different Processes and the Influence of Composition on the Keeping Qualities."

**PLANT CHEMISTRY.**—To form a basis for practical nutrition investigations the composition of vegetable proteins and the forms in which nitrogen occurs in plants were studied. The prussic-acid content of various forage and medicinal plants was determined by an improved method which has been published. Among other plant chemical problems, the properties of saponin and saponin-bearing plants were investigated, and special attention was given to medicinal plants containing emodin for the purpose of improving analytical methods. A new volatile oil has been isolated from the flowers of the cotton plant and examinations have been made of the glucoside found in its leaves. The work done by the bureau in connection with this plant was for the purpose of assisting the Bureau of Entomology in its boll-weevil investigations.

Analyses were made of the different varieties of American forage grasses, and a report on their composition was made to the Bureau of Plant Industry for use in the preparation of the bulletin, "Native Pasture Grasses of the United States."

Investigations of the bureau in connection with the production, botanical composition, and volatile-oil strength of American wild mustard seed and the hydrogen number of the essential oils of sassafras, anise, fennel, clove, and pimenta have been published.

**VEGETABLES AND FRUITS.**—Experiments in the drying of potatoes on a commercial scale were begun during the year. Preliminary experiments were made in methods of manufacturing potato starch, glucose, and dextrin and in practical methods of ensiling potatoes. The propagation of desirable lactic-acid bacteria for inoculation of ensilage was commenced.

Some of the results of the experiments and investigations in connection with the utilization of surplus fruit were published in Department Bulletin 241, "Studies on Fruit Juices," and in a Yearbook article on "Apple Sirup and Concentrated Cider."

Studies were continued in California on the ripening of oranges. A tentative standard for determining maturity, based upon the ratio of acids to solids, proposed by the bureau, was generally adopted by the orange growers.

Attention was given to the development of methods of manufacturing citric acid, lemon oil, orange juice, orange vinegar, and other by-products of citrus fruits.

In cooperation with the Bureau of Plant Industry the composition of oranges and lemons from selected trees was determined, with the object of making selections in propagation experiments.

Investigations of the mottled-leaf disease of citrus trees, in cooperation with that bureau, demonstrated that such trees, in addition to lime, require considerable organic matter, which may be best supplied through green manuring.



Experiments in relation to the absorption by crop plants of boron applied to the soil through manure treated with borax to destroy the larvæ of the housefly were completed. The results of these investigations are in the course of preparation for publication.

**SHELLFISH AND FISH.**—A new method was devised for the bacteriological examination of shellfish. In cooperation with food officials of interior States, investigations and experiments were conducted regarding the bacteriology of shucked oysters. It was discovered that a yeast was the probable cause of the reddening which affected thousands of gallons of oysters during the past season. A method was devised for determining the adulteration of scallops with water. In cooperation with the Bureau of Fisheries, investigations were commenced in regard to the freezer storage of fish treated in various commercial ways. Complete analyses of many fish were made. Continuance of the sardine investigations resulted in a further improvement in the quality of the pack. Methods for utilizing waste in the sardine industry were recommended. In cooperation with the Bureau of Animal Industry, the feeding value of fish meal was determined.

**POULTRY AND EGGS.**—Nutrition investigations were commenced to determine the best methods of feeding poultry, after receipt by the packer, for increase in weight and in quality. Studies upon the breakage of eggs in transit were the basis of definite recommendations to the industry on bracing eggs in cases, bracing cases in cars, and bracing, buffing, and shifting cars in transit. The adoption of these recommendations has largely decreased damage in transit. Department Bulletin 51, "A Bacteriological and Chemical Study of Commercial Eggs in the Producing Districts of the Central West," was published. Demonstration work in the transportation, storage, and general handling of dressed poultry and eggs was extended to new territory in Oklahoma, Kansas, and Indiana. A partial description of this work was published in a Yearbook article, "The Egg and Poultry Demonstration Car Work in Reducing our \$50,000,000 Waste in Eggs."

**INSECTICIDES AND FUNGICIDES.**—Several new lead arsenates and lead-chlorarsenates were prepared and their properties studied. The cause of injury to foliage by di-lead-arsenate—of which several thousand tons are used annually for spraying purposes—was found to be due, in many cases, to its decomposition by salts that occur naturally in the waters which are used for its application. A lead arsenate which is stable under these conditions was prepared. This is now being tested by the Bureau of Entomology to determine its efficiency for spraying purposes.

In cooperation with the Federal Horticultural Board, a method was devised of fumigating cotton bales with hydrocyanic acid gas, in order to guard against the introduction into this country of the pink bollworm through the importation of Egyptian cotton.

In cooperation with the Bureau of Entomology, it was found that hellebore is a practical and effective larvicide for preventing the development of the house fly in manure without affecting its fertilizing value. A summary of this work, with similar work of the preceding year, was published in Department Bulletins 118 and 245.

**SALT.**—A practical method was devised, and is now in use, to remove barium chlorid from brines in the manufacture of salt.

**PHARMACOLOGICAL INVESTIGATIONS.**—Investigations upon the pharmacology of the organic acids were continued, and some of the data upon citric, tartaric, and oxalic acids were published. A thorough study of the oil of chenopodium was completed and published. This oil, advocated in hookworm disease, was found to be quite toxic. Much attention was paid to the pharmacology of water-soluble and fat-soluble dyes used in foods.

**SIRUP—SUGARS.**—Important progress was made in investigations for the improvement of the methods of manufacture of cane sirup in order to obtain a uniformly bright sirup that will not ferment. A similar investigation for the improvement of sorghum sirup was commenced. Investigations to improve the methods of manufacture of candy, jams, preserves, jellies, and marmalades were continued. Improved methods were devised for the preparation of a number of sugars. A method of preparing raffinose has been published. The mutarotation of the sugars was under investigation and the rotatory power of a series of sugars and sugar derivatives was accurately determined. Some of these investigations, as well as others upon the action of enzymes upon sugars, have been published. The following new compounds were prepared and made the subject of publications: The second, third, and fourth pentacetates of galactose, the alpha tetracetate of xylose, the alpha pentacetate of mannose, and the alpha and beta pentacetates of fructose.

**DUST EXPLOSIONS.**—Large property losses occur annually from dust explosions in the thrashing and milling of grain. It is reported that during the year 1914 more than \$1,000,000 worth of property was destroyed in thrasher explosions in the States of Washington, Idaho, and Oregon. In cooperation with the Bureau of Mines and the Office of Public Roads and Rural Engineering, these explosions, as well as mill and elevator explosions, were investigated and means were devised which it is believed will render these accidents less frequent. Incidentally, observations were made for the Bureau of Mines upon the explosiveness of dusts.

**LEATHER AND TANNING.**—Methods for the determination of sugar in leather and for the detection of oak in tanning extracts and leathers were published. Much work was done to devise methods to determine the durability of leathers. Studies were made and published on the purification and disposal of tannery wastes.

**CEREALS.**—Microchemical, chemical, and baking investigations were commenced to devise methods for the examination of the various grades of flour. Experiments upon flour substitutes and upon the methods of wrapping bread were also undertaken, and some of the results have been published. Owing to climatic conditions, the rye crop contained an unusual amount of ergot. Rye products were therefore studied with a view to devising better methods for the detection of ergot in them.

**ANALYTICAL METHODS.**—Methods for the estimation of caffen and antipyrin in admixture, the estimation of antipyrin, the estimation of phenacetin and salol in admixture, and the electrolytic separation

and determination of zinc, copper, and iron in the presence of arsenic, and studies of the ash and acidity of vanilla extracts have been published.

Studies were made of the determination of lead in baking powder, of the Kjeldahl method of determining nitrogen, of the determination of arsenic and tin in canned goods, of the determination of moisture in foods, of mercury in surgical dressings, of pepsin in chewing gum, of ethyl nitrite in sweet spirits of niter, of lime in butter made from limed cream, and of citric acid in the presence of other organic acids. New methods for the analysis of vinegars and of aromatic spirits of ammonia were under consideration.

### REGULATION.

DOMESTIC FOODS AND DRUGS.—The reorganization of the bureau's field service into three districts, outlined in the bureau's report for the year ended June 30, 1914, resulted in more efficient inspection of foods and drugs moving in interstate and foreign commerce and in more systematic action in the administration of the Federal food and drugs act.

Special attention was given during the year to interstate traffic in adulterated pepper. Pepper shells have been imported in large quantities and utilized as an adulterant for ground whole pepper. The distribution of the shells was investigated, factories were inspected, and many samples of the raw and the finished product were analyzed. Through the collection and analysis of products of particular manufacturers over a considerable period of time it appeared in many cases that the adulteration was deliberate and extensive and not an accident or due to a single instance of carelessness. Seizures of a very considerable number of interstate deliveries brought forth assurances that mixtures of pepper and pepper shells will hereafter not be sold merely as pepper, but if sold at all will be truthfully described on the label.

Adulteration of oats by the deliberate addition of barley, weed seeds, or water also was investigated. A large number of consignments were seized, with the result that the practice has been largely discontinued.

An extensive investigation was made of the coffee trade. It was found that certain merchants were mixing shipments of high-grade coffee with cheaper and inferior brands, and shipping and selling the mixture to the trade throughout the country as coffees of the higher and more expensive grades. After considerable inspection work, the practice, which was widespread and successful because of the inability of the vendee ordinarily to determine for himself the actual grades of coffee, has been largely corrected.

Among the many forms of adulteration of foods that have received special attention are the adulteration of canned tomatoes with water, of dried apples with water, and of cider vinegar with distilled vinegar; the canning of decomposed cull beans; and the manipulation of smutty barley by liming.

In cooperation with the Bureau of Standards, extensive experiments were undertaken with a view to establishing special "tolerances and reasonable variations" under the net-weight amendment



to the food and drugs act. The study of dairy products is nearly completed and the results will soon be published.

Special attention was given to medicines and mineral waters bearing false and fraudulent labels. Fifty-six cases based upon such violations of the act have been disposed of in the courts favorably to the Government. Many more cases of this type are pending.

The reorganization of the field service has also led to closer cooperation with State and municipal officials. An example of such cooperation was the campaign conducted against the traffic in discarded or rejected shell eggs. These eggs, as a rule, contained a very large proportion of completely decomposed eggs and of other eggs in various stages of spoilage, with a certain proportion of fairly satisfactory eggs which might be suitable for breaking and preparing dried or frozen eggs. Cooperation with the State and municipal officials of Illinois was effective in suppressing commerce in eggs of this type. For the purpose of saving the small percentage of edible eggs which are sometimes present in these shipments, a conference was held with the egg trade and with a special committee of the National Association of State, Dairy, and Food Commissioners. As a result of this conference the State of Illinois passed a special act regulating the handling of this class of eggs, requiring that it be done in establishments entirely under its control, prohibiting traffic in eggs which are known to be bad, and regulating very carefully the traffic in eggs which might be classed as doubtful. A similar regulation of this class of eggs has been established in the State of Kansas. The general effect of this cooperation between Federal, State, and municipal officials has been to bring about a much improved condition in the trade.

Similar cooperation was undertaken in conjunction with the food commissioners of the States of Illinois, Iowa, Missouri, Kansas, and Nebraska, and the Bureau of Animal Industry, for the purpose of improving the milk supplies of the small cities near State boundaries. Temporary headquarters were established in the towns in which the milk supply was to be investigated and, with the aid of the State chemists and inspectors and the city officials, thorough surveys were made of the milk supply of each town. In cases in which the milk was found to be very dirty or high in bacterial count or watered and skimmed, a special visit was paid by the inspectors, in company with the dairy expert of the Bureau of Animal Industry, to the farms from which the milk came. This party made a sanitary survey of the dairy, suggesting to the farmer possible improvements which might enable him to produce a more satisfactory quality of milk. In those cases in which chemical examination indicated adulteration or misbranding, due either to watering or skimming, a test was made of the milk from the herd. The milk shipments from these farms were then again examined later and as a rule a marked improvement in quality was found. This plan has the advantage over those usually pursued in that results are more permanent. Milk producers learn how to improve methods and State and municipal officials continue the work, thus leading to the permanent improvement of the milk supply.

In cooperation with the commissioners of various States, the Public Health Service, and the oyster industry, the sanitary survey of

oyster beds which has been in progress for two years has been continued on the North Atlantic coast. It is leading to a more satisfactory control of the traffic in oysters from polluted waters. This work was extended to the interstate traffic in clams from polluted sections in New England.

The work of the Office of State Cooperative Food and Drug Control has been an important factor in making the cooperative work of the bureau effective. The establishment of this office was discussed in this report for the year ended June 30, 1914. Conferences have been held with all but one or two of the food, drug, and feed officials of the States. The State officials have been notified of such violations of their own laws as have been noted by Federal inspectors in the course of their regular work. State officials have been encouraged to take advantage of the authority conferred upon them by the Federal act to institute proceedings against illegal products upon their own initiative. Such a course is particularly desirable when quick action is demanded, as in the case of spoiled or decomposed perishable food products. The direct result has been that a considerable amount of such material has been barred by State authorities from sale as human food.

For a number of years a mass of information of the greatest value in the enforcement of the food and drugs act has been accumulating in the files of the Bureau of Chemistry, but it has not been in a form available for use in the bureau or elsewhere. This material is being carefully prepared so that it may be readily used and distributed to State officials.

The office of State cooperative food and drug control has also largely assisted the joint committee on definitions and standards. The organization and functions of this committee were described in this report for the year ended June 30, 1914. This committee has considered standards and definitions for flours and meals (exclusive of feeds), nonalcoholic and carbonated beverages, milk products, cocoa and chocolates, dried fruits, edible cereal pastes, gluten products and diabetic foods, soda flavors, and maple products. It has proposed standards and definitions for cacao products, gluten products and "diabetic" foods, macaroni, spaghetti, vermicelli, and similar alimentary pastes, egg noodles and plain noodles, condensed milk or evaporated milk, and maple products.

During the year a Food Inspection Decision, No. 158, based upon the recommendation of the committee, defining condensed milk, evaporated milk, or concentrated milk, was issued.

Seventy-nine opinions in the form of letters or rulings were published during the year in the Service and Regulatory Announcements.

INSPECTION.—Official samples numbering 4,412, besides 873 unofficial samples, were analyzed. Check analyses were made of 269 official samples. The number of samples analyzed is considerably less than in former years, because through cooperation between inspectors and laboratories incident to the reorganization of the bureau the collection of samples has been systematized and the collection of duplicate samples has been avoided to a greater extent than heretofore. There has also been less duplication of analytical work in

the laboratories. The following table shows the number of analyses of interstate samples at each laboratory in each inspection district:

*Examination of interstate samples.*

Laboratory.	Samples analyzed.	Check analysis samples.	Total number of interstate analyses.
<b>Eastern district:</b>			
Boston.....	273		273
Buffalo.....	219	1	220
New York.....	516	28	544
Philadelphia.....	107	1	108
Porto Rico.....	14		14
Savannah.....	199	5	204
Washington.....	290	7	297
Total.....	1,618	42	1,660
<b>Central district:</b>			
Chicago.....	1,041	145	1,186
Cincinnati.....	446	9	455
New Orleans.....	181	1	182
St. Louis.....	428	16	444
St. Paul.....	169	28	197
Total.....	2,265	199	2,464
<b>Western district:</b>			
Denver.....	174	2	176
Honolulu.....	16		16
San Francisco.....	214	26	240
Seattle.....	125		125
Total.....	529	28	557
Grand total.....	4,412	269	4,681

While the number of samples collected during the year was less than in previous years, the percentage of violations noted in the samples collected was greater than in previous years. This is believed to be due to closer supervision exercised over the collection of the samples.

As a result of the inspection work of the bureau, 491 recommendations for seizures and 276 recommendations for criminal prosecution were made through the office of the solicitor to the Department of Justice. In addition, evidence of conspiracies to violate the Federal food and drugs act was presented directly to some of the United States attorneys. In one case convictions and the imposition of large fines resulted. Information was also furnished to representatives of the Department of Justice of apparent violations of section 240 of the Penal Code.

Special attention was given to the inspection of foods and drugs shipped into Alaska, both at points of origin and at points of destination.

**IMPORTATIONS.**—Shipments of food and drugs offered for importation into the United States numbering 103,343 were examined. Of these shipments, 7,744, comprising 6,713 shipments of food and 1,031 shipments of drugs, were denied entry. Of the total number of shipments examined, 20,238 samples were analyzed in laboratories and 83,105 samples received floor inspection.



The work done on import samples by each laboratory in each district is shown by the following table:

*Examination of import samples.*

Laboratory.	Samples analyzed.	Samples inspected on floor.	Total import samples.
Eastern district:			
Boston.....	1,379	11,848	13,227
Buffalo.....	345	113	458
New York.....	10,458	37,003	47,461
Philadelphia.....	842	3,721	4,563
Porto Rico.....	676	2,766	3,442
Savannah.....	188	30	218
Washington.....	23	0	23
Total.....	13,911	55,481	69,392
Central district:			
Chicago.....	643	3,131	3,774
Cincinnati.....	1,611	324	1,935
New Orleans.....	438	2,023	2,461
St. Louis.....	88	561	649
St. Paul.....	115	292	407
Total.....	2,895	6,331	9,226
Western district:			
Denver.....	103	119	222
Honolulu.....	556	3,925	4,481
San Francisco.....	1,699	11,788	13,487
Seattle.....	1,074	5,461	6,535
Total.....	3,432	21,293	24,725
Grand total.....	20,238	83,105	103,343

The number of importations allowed entry after relabeling was unusually large, on account of the fact that a very large number of shipments were detained for failure to comply with the net-weight amendment to the Federal food and drugs act, which took effect during the year. Partly because of this amendment, partly because more attention was paid to the supervision of importations at ports on the Pacific coast, and partly because of abnormal trade conditions, the number of shipments examined was nearly 2,500 in excess of the number examined during the fiscal year ended June 30, 1914.

An effective campaign of inspection was conducted along a part of the Canadian frontier to prevent the importation into the United States of adulterated milk and cream.

MISCELLANEOUS EXAMINATIONS.

In addition to import samples and interstate samples, the field laboratories of the bureau analyzed a large number of miscellaneous samples. The following table shows the number of miscellaneous samples analyzed by each laboratory in each district, together with the total number of samples of all classes analyzed in each laboratory of each district.

*Examination of miscellaneous samples.*

Laboratory.	Miscellaneous samples analyzed.	Total samples analyzed.
Eastern District:		
Boston.....	192	1,844
Buffalo.....	55	620
New York.....	187	11,189
Philadelphia.....	46	996
Porto Rico.....	5	695
Savannah.....	34	426
Washington.....	37	357
Total.....	556	16,127
Central District:		
Chicago.....	539	2,368
Cincinnati.....	347	2,413
New Orleans.....	61	681
St. Louis.....	156	688
St. Paul.....	622	934
Total.....	1,725	7,084
Western District:		
Denver.....	203	482
Honolulu.....	6	578
San Francisco.....	220	2,159
Seattle.....	244	1,443
Total.....	673	4,662
Grand total.....	2,954	27,873

## STANDARDIZATION AND COLLABORATION.

The standard type samples for the grading of rosin, prepared by the Bureau of Chemistry, were adopted by the boards of trade of Savannah, Ga.; Jacksonville, Fla.; Pensacola, Fla.; and Mobile, Ala.; the produce exchanges of New York City and New Orleans, La., and the State of Florida. Independent producers, dealers, and consumers generally also adopted these standards. These types have thus become the recognized standards on which all rosin transactions are based. It was contemplated that the glass types should be used in all grading, but it was impossible to secure enough of the proper material from European countries, with the result that a sufficient number of standards is not yet available. The glass standards, therefore, have been used mainly for the preparation of rosin types. Examinations of these types by the bureau have shown less variation than existed before the glass standards were issued. The agreement with the standard, however, is not entirely satisfactory, as the bureau has frequently pointed out, owing to the great difficulty in obtaining rosin precisely on the standard and to difficulty in cutting the pieces of rosin.

Collaboration with the University of Idaho on the chemical utilization of Idaho woods, begun during the previous fiscal year, was continued.

For other bureaus of the Department of Agriculture 10,292 samples were analyzed by the laboratories in Washington, while 1,596 samples were analyzed for other executive departments and Government establishments, making a total of 11,888 samples. This total does not include samples that were analyzed by the branch laboratories of the field service of the bureau.

## REPORT OF THE CHIEF OF THE BUREAU OF SOILS.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., Sept. 15, 1915.*

SIR: I have the honor to transmit herewith a report covering the operations of the Bureau of Soils for the fiscal year ended June 30, 1915.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### SOIL SURVEY.

#### PROGRESS OF THE WORK.

Within the fiscal year ended June 30, 1915, detailed soil surveys were completed or begun in 97 areas located in 32 States, and a total area of 40,389.5 square miles, or 25,849,280 acres, was mapped. Reconnaissance surveys were carried on in two States and a total area of 10,161 square miles, or 6,503,040 acres, was mapped. Reports covering the detailed areas have been published or are in course of preparation for publication, each report accompanied by a map, on the scale of an inch to the mile, showing the distribution and location of the various types of soil, the roads, houses, railways, and streams. The detail surveys usually cover a county. These 97 surveys were not all begun and completed in the year 1915, as in some work was begun the previous year and in others work was still in progress at the close of the year. Reports on the areas covered by the reconnaissance surveys include soil maps on a scale of about 4 miles to the inch, and the area surveyed usually covers several counties.

The total area covered by detailed soil surveys in the United States from the beginning of the work in 1899 to June 30, 1915, amounts to 369,928.5 square miles, or 236,754,240 acres, and by reconnaissance surveys 444,210 square miles, or 284,294,400 acres.

#### COOPERATION.

A great deal of the work of the survey is carried on in cooperation with State organizations, such as agricultural colleges, experiment stations, departments of agriculture, and geological surveys. The



State in each case either employs a force of men who work with the bureau employees or pays part of the expenses of the bureau men. The latter plan is in operation in but 1 State, while the former is in operation in 19 States. Of the 97 areas covered in whole or in part, 73 were worked under cooperative agreements with the States in which they lay, and the State assumed part of the expense of the work. The funds available for soil-survey work are not sufficient to meet the requests from these cooperating States for an extension of the work. In 10 States where funds have been available it has been impossible to arrange cooperation at all or to the extent to which such funds are available for the work. Some work has been done at the request of other bureaus and offices of this department, but in such cases the Bureau of Soils bears the whole of the expense.

#### SPECIAL SOIL STUDIES.

The study of the relation of soils to the production of the tree fruits was continued through part of the year, and a report on the fruit soils of Massachusetts and Connecticut was published. One on the fruit soils of New York State is in course of preparation. The study of the relation of soils to truck crops was carried on through the year, and a report on a part of the trucking region of New Jersey was nearly completed.

#### LAND CLASSIFICATION IN THE NATIONAL FORESTS.

The land classification work carried on in cooperation with the Forest Service under a special appropriation was prosecuted during the time when field work was practicable. Four men have been assigned to that work, and a large number of special claims have been passed on during the year in addition to the areal work, which was extended over several hundred square miles.

#### COOPERATIVE WORK WITH THE RECLAMATION SERVICE.

One man has devoted the greater part of his time during the year to the examination of proposed extensions of various reclamation projects in western United States. This work was done at the request of the Reclamation Service and reports were made to the officers of that service. Studies were carried on in Wyoming, Colorado, Texas, New Mexico, and Arizona.

#### SPECIAL WORK FOR THE DEPARTMENT OF JUSTICE.

A considerable amount of special work has been done in examining tracts of land in various parts of the country for the purpose of giving expert advice in the trial of various land-fraud cases. Such work has been done in Florida, Texas, and Idaho.

#### INQUIRIES REGARDING SOILS.

Many hundreds of letters have been written in reply to inquiries regarding soils and their treatment, and many samples of soil sent in for identification or examination have been handled.

## AREAL WORK DURING THE FISCAL YEAR.

The following tables give in detail the essential facts concerning the areal work of the soil survey within the fiscal year just ended:

*Individual areas surveyed and mapped during the fiscal year ended June 30, 1915.*

## DETAILED.

State.	Area.	Area surveyed.	
		Square miles.	Acres.
Alabama.....	Barbour County.....	<sup>1</sup> 542	346,880
	Clay County.....	694	444,160
	Walker County.....	777	497,280
	Washington County.....	<sup>1</sup> 816	522,240
Arkansas.....	Columbia County.....	<sup>1</sup> 220	140,800
	Jefferson County.....	919	588,160
	Yell County.....	661	423,040
California.....	Honey Lake area.....	<sup>1</sup> 322	206,080
	Pasadena area.....	400	256,000
	Riverside area.....	471	301,440
	Ukiah area (1914 Russian River Valley area).....	<sup>1</sup> 270	172,800
Delaware.....	New Castle County.....	108	69,120
Florida.....	Fort Lauderdale area.....	353	223,920
	Franklin County.....	541	346,240
Georgia.....	Dekalb County.....	272	174,080
	Jackson County.....	<sup>1</sup> 159	101,760
	Laurens County.....	803	513,920
	Polk County.....	317	202,880
	Turner County.....	285	182,400
	Washington County.....	669	428,160
	Wilkes County.....	188	120,320
Idaho.....	Latah County.....	422	270,080
Indiana.....	Clinton County.....	<sup>1</sup> 307	196,480
	Elkhart County.....	465	297,600
	Warren County.....	<sup>1</sup> 244	156,160
	Wells County.....	157	100,480
	White County.....	163	104,320
Iowa.....	Clinton County.....	153	97,920
	Lee County.....	<sup>1</sup> 357	228,480
	Muscatine County.....	432	276,480
	Pottawattamie County.....	<sup>1</sup> 769	492,160
	Sioux County.....	258	165,120
	Van Buren County.....	123	78,720
	Webster County.....	<sup>1</sup> 636	407,040
Kansas.....	Cowley County.....	463	296,320
Kentucky.....	Jessamine County.....	100	64,000
Louisiana.....	Lafayette Parish.....	279	178,560
	Rapides Parish.....	438	280,320
Maryland.....	Montgomery County.....	<sup>1</sup> 460	294,400
Minnesota.....	Pennington County.....	<sup>1</sup> 200	128,000
	Ramsey County.....	172	110,080
Mississippi.....	Chickasaw County.....	501	320,640
	Coahoma County.....	592	378,880
	Grenada County.....	<sup>1</sup> 147	94,080
	Jefferson Davis County.....	404	258,560
Missouri.....	Buchanan County.....	149	95,360
	Dunklin County.....	<sup>1</sup> 204	130,560
	Grundy County.....	<sup>1</sup> 238	152,320
	Harrison County.....	<sup>1</sup> 414	264,960
	Johnson County.....	<sup>1</sup> 677	433,280
	Newton County.....	200	128,000
	Pettis County.....	<sup>1</sup> 527	337,280
Montana.....	Bitter Root Valley area.....	<sup>1</sup> 292	186,880
Nebraska.....	Dawes County.....	317	202,880
	Gage County.....	<sup>1</sup> 610	390,400
	Nemaha County.....	389	248,960
	Richardson County.....	298	190,720
	Seward County.....	<sup>1</sup> 487	311,680
	Thurston County.....	387	247,680
	Washington County.....	171	109,440
New Jersey.....	Camden area.....	555	355,200
New York.....	Chautauqua County.....	<sup>1</sup> 326	208,640
	Clinton County.....	<sup>1</sup> 908	581,120
	Schoharie County.....	210	134,400
North Carolina.....	Anson County.....	86	55,040
	Columbus County.....	850	544,000

<sup>1</sup> These figures do not include portions of these areas surveyed in preceding years.

*Individual areas surveyed and mapped during the fiscal year ended June 30, 1915—Con.*

## DETAILED—Continued.

State.	Area.	Area surveyed.	
		Square miles.	Acres.
North Carolina.....	Lincoln County.....	299	191,360
	Rowan County.....	<sup>1</sup> 436	279,040
	Union County.....	<sup>1</sup> 358	229,120
North Dakota.....	Wayne County.....	615	393,600
	Bottineau County.....	303	193,920
	Dickey County.....	<sup>1</sup> 1,142	730,880
Ohio.....	Lamoure County.....	<sup>1</sup> 620	396,800
	Hamilton County.....	124	79,360
	Miami County.....	173	110,720
	Paulding County.....	<sup>1</sup> 366	234,240
	Portage County.....	521	333,440
Oklahoma.....	Trumbull County.....	<sup>1</sup> 604	386,560
	Kay County.....	238	152,320
Pennsylvania.....	Roger Mills County.....	<sup>1</sup> 557	356,480
	Blair County.....	77	49,280
	Lancaster County.....	<sup>1</sup> 467	298,880
South Carolina.....	Dorchester County.....	615	393,600
	Hampton County.....	600	384,000
	Richland County.....	410	262,400
Texas.....	Bell County.....	490	313,600
	Smith County.....	<sup>1</sup> 555	355,200
	Taylor County.....	908	581,120
Vermont.....	Windor County.....	140	89,600
Virginia.....	Fairfax and Alexandria Counties.....	108	69,120
	Frederick County.....	<sup>1</sup> 365	233,600
Washington.....	Benton County.....	113	72,320
	Franklin County.....	<sup>1</sup> 881	563,840
West Virginia.....	McDowell and Wyoming Counties.....	<sup>1</sup> 1,035	662,400
	Raleigh County.....	597	382,080
Wisconsin.....	Portage County.....	109	69,760
	Wood County.....	240	153,600
	Total.....	40,390	25,849,600

## RECONNOISSANCE.

Alaska.....	Cook Inlet-Susitna region.....	5,880	3,763,200
	Yukon-Tanana region.....	25,888	16,568,320
California.....	San Francisco Bay area.....	<sup>1</sup> 2,936	1,879,040
	San Diego area.....	3,016	1,930,240
Wisconsin.....	North part North Central area. (1914 Central Northern area.)	<sup>1</sup> 3,201	2,048,640
	South part North Central area.....	1,008	645,120
	Total.....	41,929	26,834,560

<sup>1</sup> These figures do not include portions of these areas surveyed in preceding years.

*Total areas surveyed and mapped in the several States during the fiscal year ended June 30, 1915, and the areas previously reported.*

## DETAILED.

State.	Work during 1915 (square miles).	Work previously reported (square miles).	Total.	
			Square miles.	Acres.
Alabama.....	2,829	35,804	38,633	24,725,120
Arizona.....		611	611	391,040
Arkansas.....	1,800	5,826	7,626	4,880,640
California.....	1,463	14,460	15,923	10,190,720
Colorado.....		2,809	2,809	1,797,760
Connecticut.....		1,704	1,704	1,090,560
Delaware.....	108	314	422	270,080
Florida.....	894	7,367	8,261	5,287,040
Georgia.....	2,693	13,567	16,260	10,406,400



*Total areas surveyed and mapped in the several States during the fiscal year ended June 30, 1915, and the areas previously reported—Continued.*

## DETAILED—Continued.

State.	Work during 1915 (square miles).	Work previously reported (square miles).	Total.	
			Square miles.	Acres.
Idaho.....	422	1,281	1,703	1,069,920
Illinois.....		6,770	6,770	4,332,800
Indiana.....	1,336	6,802	8,138	5,208,320
Iowa.....	2,728	3,078	5,806	3,715,840
Kansas.....	463	8,266	8,729	5,586,560
Kentucky.....	100	3,069	3,169	2,028,160
Louisiana.....	717	9,819	10,536	6,743,040
Maine.....		939	939	600,960
Maryland.....	460	4,121	4,581	2,931,840
Massachusetts.....		1,494	1,494	956,160
Michigan.....		5,015	5,015	3,209,600
Minnesota.....	372	3,913	4,285	2,742,400
Mississippi.....	1,644	16,215	17,859	11,429,760
Missouri.....	2,409	21,500	23,909	15,301,760
Montana.....	292	590	882	564,480
Nebraska.....	2,659	6,423	9,082	5,812,480
Nevada.....		235	235	150,400
New Hampshire.....		1,411	1,411	903,040
New Jersey.....	555	2,522	3,077	1,969,280
New Mexico.....		596	596	381,440
New York.....	1,444	13,030	14,474	9,263,360
North Carolina.....	2,644	18,524	21,168	13,547,520
North Dakota.....	2,065	8,064	10,129	6,482,560
Ohio.....	1,788	5,236	7,024	4,495,360
Oklahoma.....	795	3,480	4,275	2,736,000
Oregon.....		1,965	1,965	1,257,600
Pennsylvania.....	544	11,388	11,932	7,636,480
Porto Rico.....		330	330	211,200
Rhode Island.....		1,085	1,085	694,400
South Carolina.....	1,625	15,225	16,850	10,784,000
South Dakota.....		675	675	432,000
Tennessee.....		7,342	7,342	4,698,880
Texas.....	1,953	20,426	22,379	14,322,560
Utah.....		1,951	1,951	1,248,640
Vermont.....	140	227	367	234,880
Virginia.....	473	6,784	7,257	4,644,480
Washington.....	994	5,843	6,837	4,375,680
West Virginia.....	1,632	10,730	12,362	7,911,680
Wisconsin.....	349	10,404	10,753	6,881,920
Wyoming.....		309	309	197,760
Total.....	40,390	329,539	369,929	236,754,560

## RECONNOISSANCE.

Alaska.....	31,768		31,768	20,331,520
Arkansas-Missouri.....		58,000		37,120,000
California.....	5,952	7,506	13,458	8,613,120
Kansas.....		39,960	39,960	25,574,400
Nebraska.....		53,064	53,064	33,960,960
North Dakota.....		39,240	39,240	25,113,600
Ohio.....		41,420	41,420	26,508,800
Pennsylvania.....		41,405	41,405	26,499,200
South Dakota.....		41,400	41,400	26,496,000
Texas.....		92,297	92,297	59,070,080
Washington.....		13,115	13,115	8,393,600
Wisconsin.....	4,209	6,642	10,851	6,944,640
Total.....	41,929	434,049	475,978	304,625,920

## SOIL CHEMISTRY AND SOIL PHYSICS.

## POTASH.

Attention has been devoted particularly to the possible development of a domestic source of potassium salts. Four such sources have been recognized as of sufficient magnitude to meet the com-

mercial demand created by the stoppage of the normal supplies from Germany. Of these four, the giant kelps of the Pacific coast appear to rank first. There are about 400 square miles of commercially available kelp beds, but if only those on the coast of the State of California and those on Puget Sound, which are readily accessible to manufacturing sites, were worked they could meet the normal need of the country and leave a margin for export. The technical problems of producing dried kelp, kelp ash, or a pure potassium chloride are sufficiently advanced to justify commercial exploitation, but the beds are all under the control of the States, and apparently there are no State laws or regulations governing the harvesting of kelp, so that capital has been timid.

It is quite feasible to obtain potassium salts from feldspar and other potassium silicates, of which great quantities are to be found in nearly every section of the United States. But the practicability of mining on a large scale a product with a sufficiently high content of potassium to justify further manipulation and at a sufficiently low cost has yet to be demonstrated. Disinterested investigators agree that "potash from feldspar" is a commercial possibility if the by-product is also salable. The most practical suggestion is that the residue from which the potassium has been extracted should be employed in making cement. Apparently, very good cements can be thus prepared. But they do not meet the standard specifications upon which the great bulk of cement is purchased in the United States. Consequently, the cement manufacturers have been loath to remodel their plants, retrain their working forces, and reeducate their buying public in an effort to secure an industry worth but a small fraction of their existing business.

The production of potassium sulphate from alunite is technically quite feasible, but the only known deposit of massive alunite capable of commercial development is near Marysvale, Utah, a geographical location somewhat unfortunate for the fertilizer industry, which is the main consumer for potassium salts.

One of the by-products in "potash from alunite" is anhydrous sulphuric acid. The alunite deposits being situated in the Fillmore National Forest, the sulphuric-acid fumes can not be allowed to escape unchecked, and there is little or no sale for the sulphuric acid in Utah. Instead of being an asset, its disposal is a serious charge. The other by-product is alumina, from which aluminum might be produced and has been produced in an experimental way. But the only commercial producer of aluminum in the United States is amply supplied with large deposits of bauxite and is not interested in developing another source. To enter this field would involve adjustment of patent rights and the securing of a source of cheap power. Abrasives, refractories, and possibly other substances might be made from the alumina, but for these the market does not yet exist. In spite of these handicaps the pressure for potash salts is so great that plants for the working of alunite are in course of construction which will shortly produce potassium sulphate in the interest of certain fertilizer manufacturers. Since the greater part of the Marysvale alunite known to be workable is owned by two private interests, it is doubtful if "potash from alunite" is to be of interest to the fertilizer industry generally.

The desert basins have been rather thoroughly scrutinized. One only has so far shown any promise of commercial development, namely, Searles Lake, San Bernardino County, Cal. A large amount of money has been spent on the development of processes, and one process for extracting potassium chloride from the brine occurring at Searles is now being tested. It appears, however, that the commercial future of Searles Lake is more likely to be as a source of soda, with borax and potassium salts as by-products.

To sum up, so far as the technical problem is concerned, it is quite feasible to produce from American sources more than ample supplies of potassium salts. The serious difficulties now remaining are mainly commercial and psychological ones.

#### NITROGEN.

The continually increasing use of the organic nitrogen carriers as animal feeds has made it the part of prudence to seek other possible sources of supply to meet the increasing demand of the users of fertilizers. The gratifying increase in the substitution of by-product coke ovens for the antiquated "bee-hive" oven, by conserving the ammonia produced, meets the problem partly. It is hoped that the problem can be fully met with the synthetic production of nitrogen compounds from atmospheric nitrogen. Nitric acid has been produced in Norway by hydroelectric processes because of ample cheap water power, and some nitric acid has also been made in France and Austria. However important these developments may be for the explosive industry and certain other chemical manufactures, it is a growing conviction among agricultural experts that the real need is for a cheap and ample source of ammonia. Among the possibilities in this direction the most prominent is the fixation of atmospheric nitrogen as a cyanamide produced in the electric furnace, this substance cheaply and easily yielding ammonia when treated with steam. Accordingly an investigation has been made of possible installations of hydroelectric plants of suitable size to furnish the necessary power at a sufficiently low cost to justify the commercial development of nitrogen fixation. In part this work was carried on in cooperation with the authorities of the State of Oregon regarding possible developments at The Dalles and other sites.

It has been found that the technical difficulties are by no means so serious as the commercial ones. There appear to be very few places where, if it were commercially feasible to install hydroelectric power plants at all, a better price could not be obtained for the power than present nitrogen fixation processes could afford. Consequently a comprehensive laboratory investigation has been initiated with a view, among other purposes, to develop a process which can meet the relatively high cost of power now prevailing in the United States and likely to prevail in the future.

Meanwhile attention has been diverted to a more nearly complete and a more intelligent use of city and industrial wastes, especially of garbage, which by appropriate treatments can be made a useful component of fertilizers, besides producing other marketable products and giving at the same time a sanitary method of disposal. An important feature of the work is a comprehensive study of the garbage and methods of disposal for the District of Columbia being carried on in cooperation with the District authorities.



The occurrence of surface deposits of nitrates, especially in the arid and semiarid sections of the United States, is quite common and has led to many vain hopes. A number of these deposits have been investigated. Almost always the "find" is a surface deposit only; none has been found of large commercial importance, and even when sufficiently abundant to justify a local exploitation in itself the deposit is usually so situated as regards a water and fuel supply as to render working it impracticable.

#### PHOSPHATES.

It has been shown that the United States contains high-grade phosphate deposits of such magnitude as to be practically inexhaustible. Phosphates are the basis of commercial fertilizers the world over, but changing economic conditions, not only in the United States, but throughout the world, are making it desirable and probably necessary radically to change existing methods of manufacturing and marketing phosphates. The cheap production of ammonium phosphate is the ideal sought.

The bureau has been investigating improved methods of obtaining phosphoric acid by means of sulphuric acid, and it is carrying on investigations looking to the combined production of phosphoric acid and ammonia by electrical processes. Meanwhile, an investigation has been undertaken of the economic justification for the growing use of untreated phosphate rock and also of the possibility of economical decrease of wastage in mining.

#### LIME.

The use of lime in soil management is increasing greatly in this country. Fortunately large deposits of limestone admirably suited to the production of agricultural limes are to be found widely distributed throughout the United States, and the technology of the different forms of lime production is already highly developed. The bureau has during the past year made some important and fundamental studies on the absorption or fixation of lime by the particles in the soil, showing that it has generally an important effect on the absorption or fixation of other water-soluble fertilizers, and that the different forms of lime have distinctly different effects on the flocculation or crumbling of the soil, so that these different forms should not be used indiscriminately where the control of tilth is important.

#### COMPOSITION OF SOILS AND PLANT ASH.

Increasing evidence of the great mineral complexity of agriculturally useful soils has been accumulated and chemical evidence gathered that, with an occasional exception here and there, practically all soils suitable for crop production contain estimable quantities of all the mineral elements for which there are reliable methods of analysis. Incidentally it has been shown that radium and radioactive substances are present normally in soils to amounts in excess of that which could possibly be applied artificially and at the same time economically. And the same statement can be made in general for the so-called catalytic fertilizers or "activators." The work on

plant ash, while not yet sufficiently advanced to make final statements advisable, appears to show that very many if not all of the elements found in the soil usually find their several ways into the living organism, and important economic as well as scientific data are being accumulated for the further elaboration of the plant physiologists.

#### SOIL EROSION.

There are but a few States where soil erosion is not a problem of economic importance, and in some of the States, notably in certain regions of the South and Middle West, it is sometimes of the first importance to their agricultural development. Long study has shown that there are two general methods of protection: (1) To increase the capacity of the surface soil to absorb moisture, as by deep and thorough tillage, and by the incorporation of organic matter, thorough liming, etc.; and (2) by diminishing the rate of flow of surface waters, as by terracing, contour ploughing, breaks in gullies, etc. There appears to be reason for suspecting that in certain cases, at least, the inherent properties of particular soils seriously affect their liability to erosion, as in the case of certain rather heavy soils containing a large percentage of mica, which soils "flow" very readily when in contact with excessive quantities of water. Hence, a laboratory investigation is in progress of soils from different parts of the United States where erosion is a prominent factor in agriculture.

#### SOIL MOISTURE.

It has come to be recognized that every physical property of a soil affecting the growth of crops is itself determined by the moisture content of the soil and that there is a critical moisture content characteristic of each particular soil at which the aggregate of physical properties produces an optimum condition for plant growth. Consequently, the determination of this critical or optimum water content has a practical importance and a comparatively quick and rapid method for its determination has been developed.

#### SOIL PRESSURE.

If a soil containing less than the critical moisture content be further wetted, there are pressures developed which are of enormous dimensions on the surface of the individual grains as determined by theoretical calculations, and which are often of considerable magnitude on the surfaces of the soil mass. Pressures of 600 pounds or more to the square inch of soil mass have been observed in the work of the past year. These observations have a considerable interest in theoretical and practical studies on tilth. But they have a much more direct importance to engineers and practical constructors having to deal with dams, earthworks, foundations, or other like problems where the earth is liable to continual or intermittent contact with water.

#### SOIL FERTILITY INVESTIGATIONS.

The fundamental questions on which the fertility of agricultural lands depends have been further elucidated by the research work of the laboratory and field investigations of this office. The laboratory

experiments have shown a new type of organic constituents, classed chemically as aldehydes. These aldehydes originate by processes of organic decay under conditions of poor aeration or drainage and appear to be closely associated with acid soils, though not exclusively so. These aldehyde constituents are for the most part harmful to plants. Two of these soil compounds have been subjected to field tests on several soil types. On some of the types they are quite toxic, while on other types with oxidation, good lime content, and other soil factors making for a strong, virile soil, they are less harmful, or even quite innoxious. Interesting information regarding the specific effects of fertilizers in ameliorating the harmful properties of these compounds in the field has also been obtained. The solution of this problem is especially valuable in dealing with certain highly manured and fertilized garden and greenhouse soils which have been showing a falling off in crop yield. Further progress has also been made in the nature of the organic soil nitrogen compounds by the further isolation and identification of a compound belonging to a different type than has hitherto been found in soils and marking another step in our understanding of the processes of nitrogen transformation in soils.

In this connection a study of nitrogenous fertilizers and their decomposition in the soil was undertaken. The fertilizer of most interest in this investigation was that prepared commercially from cheap trade wastes by chemical treatment. The nitrogen in the untreated trade waste has proved to be of little agricultural value, but after treatment of the waste is rendered more available. This is shown to be due to the change of difficultly decomposable compounds by the treatment into easily decomposable and readily assimilable nitrogen forms. These nitrogen compounds have in part been isolated and identified. Some of these are apparently directly used by the plant, while all are much more easily attacked by the soil organisms with the formation of ammonia or nitrates than is the original trade waste.

Some further results have been reached pointing to the fact that in part at least soil compounds have arisen in the soil during the life of the plant. Molds have been found to contribute soil compounds as the result of their development in the soil. In the study of the effects of specific nitrogen compounds it was found that two of these, otherwise closely related, nevertheless showed such striking differences that one was beneficial, whereas the other was harmful, producing a decided derangement of the normal behavior of the growing plant.



## REPORT OF THE ENTOMOLOGIST.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF ENTOMOLOGY,  
*Washington, D. C., September 18, 1915.*

SIR: I submit herewith a report of the work of the Bureau of Entomology for the fiscal year ended June 30, 1915.

L. O. HOWARD,  
*Entomologist and Chief of Bureau.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### WORK ON THE GIPSY MOTH AND BROWN-TAIL MOTH.

The work on the gipsy and brown-tail moths was continued under the direction of Mr. A. F. Burgess. Many improvements were made during the year and the work is being conducted more effectively than ever before. Several of the experimental projects were practically completed and reports upon them have been or are being prepared. The colonization of introduced parasites has been carried on extensively, so that two of the species are now known to occur over most of the infested area.

STATES RELATIONS AND COOPERATION.—Effective cooperation with the States infested with these insects was continued and the work further systematized during the past year. The authorities in the infested States are encouraged to carry on as much work as possible in order to enable the bureau to concentrate its efforts on the prevention of spread of these insects. In general the field work of the bureau is carried on exclusively along the outer border of infestation in order to retard the spread as much as possible. During the past year several State laws were improved and strengthened and the work more effectively organized. This is particularly true of Connecticut, Vermont, and Rhode Island.

PROGRESS OF THE GIPSY-MOTH WORK IN NEW ENGLAND.—Extensive scouting work was carried on in 223 towns in New England, all of which are located around the outside border of gipsy-moth infestation. As a result of the work this insect was found in 4 towns in Maine, 23 in New Hampshire, 3 in Vermont, 10 in Massachusetts, and 10 in Connecticut, making a total of 50 towns from which the insect had not been previously reported. In addition to this scouting work, which consisted largely of an examination of all the roadsides, residential sections, and orchards, a large amount of woodland scouting was carried on, 43,840 acres having been examined. The egg clusters in colonies in the outside towns from Lake Winnepesaukee

to Long Island Sound were treated with creosote, the trees banded with tree tanglefoot, and 15 tons of arsenate of lead were used in spraying work in the larger infestations. The result of the work in the towns of Lenox, Stockbridge, and Great Barrington, Mass., was very satisfactory. No further infestation has been found at Wallingford or Stonington, Conn., during the past year.

PROGRESS OF THE WORK IN NEW YORK.—Although repeated examinations were made, no further traces of the gipsy moth were found at Geneva, N. Y. The colony at Mount Kisco, N. Y., was treated jointly by men employed by the State department of agriculture and by special men employed by the bureau. Scouts from this bureau examined 115 miles of roadway in Northcastle and the towns adjoining, but no infestation was found outside of the town of Northcastle, in which Mount Kisco is located. Thinning operations were carried on and the entire infested area was sprayed during the summer of 1915 by the State of New York. The infestation has been reduced to a minimum, and it is hoped that it will be possible to stamp it out.

PROGRESS OF THE WORK IN OHIO.—The infestation at Bratenahl, a suburb of Cleveland, Ohio, which was discovered last year, was given very careful attention. Thorough treatment of the infested area was carried on by the State nursery inspector and his assistants, and the colony and surroundings were carefully sprayed. Careful scouting has been done by employees of the bureau, and it is believed that this colony will soon be exterminated.

GIPSY MOTH IN NEW JERSEY.—In the summer of 1914 a male gipsy moth was captured at Rutherford, N. J. The matter was reported to the State entomologist and was later investigated by the bureau. The area surrounding the location where the moth was captured was thoroughly scouted and a number of gipsy-moth egg clusters were found. The trees and surroundings were repeatedly inspected, and the area where the infestation was found was sprayed several times under the direction of the State entomologist. The infestation is well under control, and a continuance of thorough work should result in an early extermination of the insect.

BROWN-TAIL MOTH SITUATION.—Considering the infested territory as a whole the brown-tail moth was not nearly so abundant as it was during the previous year. In some of the seacoast regions in Maine and the river valleys in New Hampshire severe infestations exist. There are also limited areas scattered over the infested territory where the brown-tail moth is rather abundant. The spread of this insect during the past year was inconsiderable. The system of collecting moths at light was maintained in cooperation with the United States Lighthouse Service along the coast of Connecticut and Long Island, but no evidence was secured which would indicate that the insect is present outside the territory previously known to be infested.

QUARANTINE WORK.—The inspection of forest products and nursery stock was maintained throughout the year. On October 25, 1914, a regulation was made by the Secretary of Agriculture requiring the inspection and certification of stone and quarry products which were shipped outside the area infested by the gipsy moth. This has

resulted in preventing the spread of the insect to many distant points. Sixteen thousand three hundred and seventy shipments of nursery stock and forest products were inspected and 10,545 egg clusters of the gipsy moth and 218 webs of the brown-tail moth were found and destroyed. Fifteen thousand nine hundred and forty-four shipments of stone and quarry products were inspected and 387 egg clusters of the gipsy moth destroyed.

**SILVICULTURAL WORK.**—The silvicultural work was continued along the same lines as during the past year. More sample plats were selected and thinned in order to secure additional data. In all 46 plats were under observation in Maine, New Hampshire, and Massachusetts. This practically completes the number of plats to be selected, and the securing of data and tabulation of results are under way.

**EXPERIMENTAL WORK.**—The experimental work in the laboratory and field on the feeding habits of the gipsy moth was practically completed, with the exception of a small amount of work which is being carried on to determine the importance of the gipsy moth as a cranberry pest. Studies of the increase of the gipsy moth under field conditions and of the relation of disease and parasites to its increase were continued, and work was done on secondary insects which attack trees that are weakened as the result of gipsy moth and brown-tail moth defoliations.

**PARASITE AND DISEASE WORK.**—Work on the introduced parasites and natural enemies of the gipsy moth and brown-tail moth and on the wilt disease were continued. More specimens of imported parasites were reared or collected and colonized during the past year than ever before. In the fall of 1914 over 2,000,000 specimens of *Schedius kuvanae* were liberated in 500 colonies, which were distributed in 110 infested towns in Massachusetts, New Hampshire, and Rhode Island. The other egg parasite of the gipsy moth, *Anastatus bifasciatus*, was collected in large numbers and nearly 10,000,000 specimens were liberated in 91 towns in Maine, New Hampshire, and Massachusetts during the spring of 1915. Parasitism in the field by the latter insect has frequently amounted to 30 per cent. *Apanteles lacteicolor*, which attacks not only the small caterpillars of the brown-tail moth but those of the gipsy moth as well, has been recovered in fair numbers this year. *Meteorus versicolor*, another parasite of the brown-tail moth caterpillars, was found more abundant than usual during the season, and *Apanteles melanoscelis*, which passes through two broods on gipsy-moth caterpillars, has increased and is doing effective work in the small area where it has been colonized. *Limnerium disparis* is established but has not increased to any great extent. The tachinid fly *Compsilura concinnata*, which attacks a large number of native caterpillars as well as those of the gipsy moth and brown-tail moth, was found in fair numbers during the year, and *Zygobothria nidicola*, an enemy of the latter species, was found in great numbers. The calosoma beetle *Calosoma sycophanta* was found abundantly, particularly in territory where it was first liberated. This insect continues to spread and is destroying large numbers of gipsy-moth caterpillars and pupæ.



## DECIDUOUS-FRUIT INSECT INVESTIGATIONS.

Investigations of deciduous-fruit insects have been carried on under the direction of Dr. A. L. Quaintance, as formerly.

**APPLE INSECTS.**—The comparative studies of the codling moth planned to cover the principal apple-growing regions in the United States have been continued. The investigations in Maine were concluded at the close of the season of 1914 and a report upon the work prepared for publication. It was found that in Maine the codling moth develops practically but one brood of larvæ each year, and a single thorough spraying of trees after the falling of the blossoms furnished adequate protection to the fruit. The investigations in New Mexico were continued and further data obtained on the control of this insect in a region where there are three full broods and a partial fourth brood of larvæ each year. The life-history studies of the codling moth in this region have been completed and a report prepared for publication.

In the spring of 1915 a field station was established at Grand Junction, Colo., in a region in which the codling moth has for many years been especially troublesome. In cooperation with the Colorado Agricultural Experiment Station, a thorough investigation of the life history and habits of the insect will be made and extensive experiments with sprays in orchards will be carried out to determine the best time to make applications in order to secure control.

During the last two or three years there has been a renewal of interest in the dusting method of applying poisons and fungicides for the control of apple insects and diseases. In order to obtain definite information of the effectiveness and cost of the new dust sprays in insect control as compared with liquid sprays, extensive experiments were undertaken in the spring of 1915 in connection with other work at the field stations in Michigan, Colorado, and New Mexico.

The life-history studies of the green apple aphid under way last year have been completed and a report upon the work is now in preparation. By the close of the season of 1915 fairly complete data will have been obtained on the biology of the rosy apple aphid, which has been under investigation during the past two years. The alternate food plant has been found to be a species of plantain commonly growing in and about orchards, and the destruction of this food plant should materially reduce the pest. Additional tests have been made in orchards in the control of the woolly apple aphid by the use of poisonous substances in water applied to the roots of infested trees. The results obtained indicate a practical remedy for this very destructive insect.

Investigations under way, in cooperation with the Bureau of Plant Industry, as to the relation of insects to the affection of apples known as stigmonose, are progressing satisfactorily and have been enlarged. Certain suspected species of insects have been isolated and are being reared in cages on fruit trees in a way to determine their possible connection with the malady.

**PEACH INSECTS.**—Work with the peach borer has been continued, and attention has been especially directed to determining the egg-laying habits of the moth and habits of the newly-hatched larvæ in entering the trees. Considerable experimentation was done in the

development of a protector to be sealed tightly around the base of peach trees to effect the total exclusion of the larvæ. Experiments with protective washes applied by means of a spray pump to the base of peach trees were carried to completion, but none of the sprays tested proved to be adequately effective.

Large-scale tests in orchards with dust sprays for the control of the plum curculio on peach were begun in the spring of 1915 in Maryland, West Virginia, and Michigan. The data obtained indicate effective control of the curculio by the use of powdered arsenate of lead. The poison is combined with finely divided sulphur and a diluent, as lime or gypsum, with the view to effecting combination work against the curculio, brown rot, and peach scab.

GRAPE INSECTS.—The biological studies of the grape *Phylloxera* in California, while practically completed by the fall of 1914, have been continued in order that further information might be obtained concerning the nymphal and winged forms of the insect. A report on these studies is practically completed and will be submitted for publication by the close of the season. The renovation work in phylloxerated vineyards has been continued, and in addition to determining the effects on the vines of deep plowing, fertilization, etc., experiments are being made with carbon bisulphid injected into the soil for the destruction of the insects in accordance with methods found effective in Europe. In cooperation with the Bureau of Soils, a study is being made of the relation of *Phylloxera* injury to different types of vineyard soil.

Field experiments in the control of the grape-berry moth in the Lake Erie Valley have been continued along principally three lines, as outlined in the preceding report, namely, the use of arsenical sprays, hand picking of infested fruit, and the covering of fallen foliage in vineyards by fall plowing. In response to requests from vineyardists, investigations have been made to determine the status of the insect in northern Ohio, where it is causing considerable injury.

NUT INSECTS.—Material progress was made during the last fiscal year in the studies of pecan insects in the South. A large amount of data has been accumulated. Fairly complete information has been obtained on the life history of the leaf case-bearer, the nut case-bearer, and the shuckworm. Numerous other species have been studied, such as the budmoth, the cossid borer, and the twig girdler. In the experiments in the use of arsenicals on pecan it has been found that the foliage is very tender, and that these must be used with caution.

ORCHARD INSECTICIDES AND SPRAYING MACHINERY.—Work on orchard insecticides and spraying machinery has been continued about as last year, and has included the testing of miscellaneous proprietary insecticides. Further tests in apple orchards have been made with arsenate of lime, and the results now leave little doubt that this arsenical, which costs about one-half as much as arsenate of lead, will be a satisfactory substitute for the latter.

NURSERY INSECTS.—Studies of nursery insects were undertaken in the fall of 1913, and comprise an investigation of deciduous-fruit nursery insects and the development of methods of control practical under nursery conditions. Especial attention was given during the

past fall and spring to the investigations of the details of fumigation as at present practiced by nurserymen, with the view of standardizing the process. Purchasers of trees often complain of the ineffectiveness of fumigation in killing insects, especially the San Jose scale, and of injury to the trees by the treatment. The apple leafhopper, which infests orchards and nurseries, is also under investigation.

**CRANBERRY INSECTS.**—Work with cranberry insects in New Jersey has been continued, and material progress is being made. The abundance of the black-headed cranberry worm has offered opportunity for large-scale reflowage experiments. It was found that most effective work could be done in destroying the black-headed worm if the plants were submerged for a period of 4 or 5 days when the insects were mostly in the pupal stage. Such treatment was found not to be injurious to the plants. Arsenicals and kerosene sprays did not prove effective in the control of this species, though a nicotine spray gives promise of much value. Important facts bearing on the control of the cranberry girdler have also been determined, namely, that the usual fall flooding of vines for 10 days is useless unless done before about October 1.

#### SOUTHERN FIELD-CROP INSECT INVESTIGATIONS.

Investigations of southern field-crop insects were continued, as in former years, under the direct charge of Mr. W. D. Hunter.

**COTTON INSECTS.**—The principal pest considered in relation to cotton culture was the boll weevil. During the year the work on this insect was reorganized to constitute a more intensive investigation. It was also necessary to add to the force to enable the bureau to meet the demand for the specific information regarding local weevil conditions that is required by the demonstration service of the department.

The annual dispersion of the boll weevil in the fall of 1915 assumed unusual proportions, due to the tropical storms. Very extensive areas were newly infested in Florida, Georgia, Alabama, and Tennessee, as also in Oklahoma and western Texas.

The laboratory at Tallulah, La., conducted numerous experiments in practical control and made a special study of the local variations in weevil injury. One of the most conspicuous features of the boll-weevil problem is the variation in yield in crops grown apparently under the same conditions. A large number of field examinations were made to determine the cause of this variation. The matter is a complicated one, as soil, subsoil, climatic and other conditions, including the previous cropping of the land, are involved. It is hoped that when this work has been prosecuted for some time it will be possible to determine the exact factors which contribute to the successful production of cotton. The work on direct control measures consists of tests of the value of hand picking of infested squares, and of removing all of the fruit from a plant at the time when weevils are at the lowest ebb in the spring, as well as tests of several mechanical means. The life-history work dealt with the determination of the ability of weevils to hibernate successfully when deprived of food, when fed plants other than cotton, and when fed upon different parts of the cotton plant. Considerable attention



was devoted to the study of the parasites of the weevil and the relation between the control exerted by these insects and the various cultural practices that are followed in the infested region. Special studies were made to determine the relations between the spacing of the plants and the date of thinning and weevil injury.

The usual work was done by the agents of the bureau in determining the spread of the weevil during the season. As a result a map was published in the fall showing the progress of the insect, for the use of State officials concerned in quarantine.

An agent was stationed in Arizona to study the cotton weevil closely allied to the boll weevil which was discovered in that State a few years ago. It was found that the Arizona weevil will attack cotton and did so in the case of experimental plantings. It was also found that this weevil had a very surprising ability to withstand arid conditions. In fact, it is quite possible for it to live in a semi-dormant condition for an entire year. If this weevil were introduced into western Texas, the conditions would undoubtedly be favorable for its propagation and this would interfere seriously with the development of the cotton industry in that region.

The work on the cotton red spider was continued at Batesburg, S. C., and a laboratory was established at Thomasville, Ga., for the study of the numerous species of insects which, in addition to destroying a large amount of fruit of the cotton plant, carry the spores of certain diseases. The work upon this subject, which was in cooperation with the Georgia State Board of Entomology, showed that the importance of various insects which have been considered minor pests of cotton has been greatly underestimated.

**TOBACCO INSECTS.**—Farm tests of powdered arsenate of lead as a remedy for the tobacco hornworm were made on 126 localities in 16 counties. The experiments were highly successful and the indications are that in the near future arsenate of lead will entirely supplant Paris green as an insecticide for tobacco worms.

The so-called mosaic disease of tobacco was found to be transmitted commonly by several species of insects. In fact, any insect which travels from an infected to an uninfected plant is likely to convey the disease. It thus becomes necessary to pay considerable attention to a number of species which have been considered minor pests of the tobacco plant, as it appears that the damage that they may do in conveying the mosaic disease is considerably more important than the direct injury caused by feeding upon the leaves.

In experiments conducted in Florida it is shown that arsenate of lead is a very much more efficient and economical poison against the tobacco budworm than Paris green. As a result of local work in Florida, the planters applied this discovery to an area of 700 acres. In a short time it is believed that the new poison, which results in the saving of several dollars per acre in the cost of production, will come into universal use where the tobacco budworm occurs.

**SUGAR-CANE INSECTS.**—Work on sugar-cane insects was continued in cooperation with the Sugar Experiment Station of the State of Louisiana at New Orleans. The most important discovery made was in the relation between the burning of the tops of the cane in the field and the abundance of the moth borer, which is the most destructive sugar-cane insect in the United States. It appears from

preliminary observations, which are being verified, that the burning of the tops, which is an almost universal practice, destroys parasites of the borer and thus removes a very important agency in holding the pest in check. In fields where the tops had not been burned the infestation by the insect was found to be greatly lessened. An agent was sent to Cuba to investigate the parasites of the moth borer in that island. He succeeded in obtaining several species which do not occur in Louisiana. One of them is now being propagated, but no prediction as to the ultimate outcome can be made at this time. Tests of the feasibility of controlling the borer in young cane plants by the use of poisons were undertaken with successful results.

**ARGENTINE ANT.**—The principal work on the Argentine ant dealt with its relation to the sugar-cane mealy bug and with its control under urban conditions. Experimental growths of sugar cane upon which the mealy bug was planted showed that when the ant has access, multiplication and spread are much more rapid than without the access of the ant. The ant therefore has the effect of causing a pest of rather inconsiderable importance to assume a new rôle. In the work of controlling the ant under urban conditions extensive experiments were performed in Hattiesburg, Miss. An especially prepared poison mixture was exposed, with the result that the number of ants was greatly decreased. It now appears that the perfection of this poison mixture supplies an economical and effective means of controlling this pest in cities.

During the latter part of the summer of 1915 the ant was found established at points in Georgia and North Carolina. A vigorous campaign with the new sirup at Augusta, Ga., brought partial relief within a few weeks.

#### INVESTIGATIONS OF INSECTS AFFECTING THE HEALTH OF MAN.

The work on insects affecting the health of man dealt with the mosquitoes which transmit malaria and their control, with the house fly, with the eradication of the Rocky Mountain spotted-fever tick, and with the possible function of insects in the transmission of pellagra.

The work on malaria mosquitoes was conducted in Madison Parish, La., on a large plantation where exceptional facilities for the work were available. A study was made of the economic importance of malaria and the loss to the planter resulting from invalidism due to this disease. The study indicates that there is an annual loss of about \$6 per acre attributable to malaria. The work included studies of the habits of the various species of mosquitoes which transmit the disease and of methods of control. The investigation was assisted greatly by Tulane University, and by the United States Bureau of Fisheries, which placed an investigator in the field for the special purpose of studying the top minnows which are important agencies in the reduction of the numbers of mosquitoes.

The work on the house fly consisted of a continuation of the experiments of previous years in testing various compounds for the destruction of the immature stages of the insect in stable manure. This investigation was on a cooperative basis with the Bureau of Chemistry and Plant Industry. It was found that while borax will undoubtedly be the most desirable agent for the destruction of the fly

larvæ in stable manure, another substance, hellebore, has certain advantages. If excessive amounts of borax are applied there is likely to be injury to crops when the manure is used as a fertilizer; but hellebore, being volatile, does not have any injurious effect whatever on the manure. Important results were also obtained in testing other means of controlling the house fly, particularly in the use of the so-called maggot trap, which furnishes a very economical means of removing the larvæ from manure without the addition of any chemicals. In fact, the use of the maggot trap will enable the farmers to obtain more fertilizing value from the manure than is the case under the usual methods of management.

The work on the spotted-fever tick in Montana was continued in cooperation with the Montana Board of Entomology and the United States Public Health Service. The operations consisted of systematic dipping of the animals which support the adult stage of the tick. The work was well received by the people directly concerned and promises to reduce very greatly the number of cases of spotted fever in the Bitter Root Valley.

The work on the possible transmission of pellagra by insects, which had been under way for two years in cooperation with the Thompson Pellagra Commission, was discontinued for the reason that the findings indicated that there is only an extremely remote possibility that insects may be concerned in the spread of the disease.

A new line of work was instituted at the urgent request of the Bureau of Animal Industry, namely, an investigation of house flies and related insects in the establishments operating under the meat inspection act. These meat-packing establishments present many peculiar problems in the control of the house fly. An agent visited several of the larger establishments in the country and was able to supply information that enabled the Bureau of Animal Industry to take immediate steps that had the effect of reducing greatly the annoyance and danger from flies in the establishments operating under Federal control.

#### INVESTIGATIONS OF INSECTS AFFECTING THE HEALTH OF ANIMALS.

The investigations of insects which affect the health of animals dealt with the flies causing myiasis, with the so-called nose fly of the North Central States, with the stable fly, horn fly, ox warbles, and other species. The so-called screw-worm fly attacks living animals throughout the southwestern part of the United States. In some locations it is so abundant that it causes heavy mortality among young calves. The investigations showed that this pest develops very largely in carcasses, and experiments were conducted to determine the proper methods of preventing the breeding of the pests in such situations. Extensive tests were also made of various substances which attract the adult flies and which may possibly be used in attracting the insects to traps or poisoned baits.

It is found that the so-called wool maggot of sheep is a source of considerable loss to producers in western Texas as well as in other States. Apparently the attack on sheep is a recently acquired habit of one of the species of blowfly. As the blowflies of other countries, notably Australia, are very important in causing losses to sheep raisers, it is possible that the American species may eventually develop into a pest of prime importance. It therefore requires special investigation.



Inquiries developed the fact that two, instead of one, species of ox warble occur rather abundantly in the United States. Exact information regarding the range of the different species was obtained and studies were made of their relative importance and their exact effects on the hosts.

The nose fly (*Gastrophilus haemorrhoidalis*) has recently assumed considerable importance in the North Central States. This pest occurs in great abundance during the harvest season and interferes greatly with the work, since horses are practically uncontrollable when it makes its attack. An agent was placed in South Dakota to investigate this problem, which is an entirely new one and of more than local importance, because the fly is undoubtedly spreading rapidly to other parts of the country.

#### CEREAL AND FORAGE INSECT INVESTIGATIONS.

Work on cereal and forage insects was continued under the direction of Mr. F. M. Webster.

**RANGE CATERPILLAR.**—The investigations of the range caterpillar were continued throughout the fiscal year. Since any measures requiring any considerable expenditure of time and funds would be impracticable because of the wide range of country infested by the pest and the low returns from the land, special attention was given to the introduction of parasitic and predaceous insects with the hope that these could be colonized in numbers sufficient to control the range caterpillar. With this end in view an agent was sent to New England to obtain as many pupæ as possible of *Compsilura concinnata*, the imported fly parasite of the gipsy moth and brown-tail moth, to be forwarded to Koehler, N. Mex., the nearest railway station to the camp established for the investigation of the range caterpillar. More than 5,000 specimens were sent. Up to the close of the year no specimens have been recovered, but it is quite possible that the parasite will eventually be found to have become established.

Better results were obtained in the introduction into New Mexico of an American and an imported species of predaceous beetle of the genus *Calosoma*. Both *Calosoma calidum*, from Missouri, and *C. sycophanta*, the European species which attacks the gipsy moth, were recovered on the cattle ranges, showing that they passed the winter successfully and are now probably permanently colonized in New Mexico.

In March, 1915, about a thousand cocoons of a hymenopterous parasite which may attack the range caterpillar were obtained in California and sent to New Mexico.

Until the present year the range caterpillar was supposed to feed almost exclusively upon grasses of the genus *Bouteloua*, but it is now known to feed also upon cultivated grains, thus rendering it of more importance than was formerly supposed.

**TRUE ARMY WORM.**—A considerable portion of the time of a number of the men connected with these investigations was occupied with an investigation of the true army worm, which, starting in New Mexico in the very early spring, covered almost the entire country east of the arid plains and did a great deal of damage. The outbreak in Texas was the first that has been recorded as occurring in that State.

The result of the investigation was that much additional information was accumulated relative to this old and supposedly well-known pest. Early in the spring of 1915 this species again occurred in Oklahoma, and at the end of the year was excessively abundant in eastern Nebraska, western Iowa, southeastern South Dakota, northeastern New Mexico, and southern Virginia.

**SO-CALLED "GREEN BUG."**—As reported last year, the spring grain-aphis, or "green bug," received a very serious setback in northern Texas from the millions of parasites that developed on species of plant-lice related to it, and it did not occur in any abundance over the area where this peculiar situation regarding parasitism was observed to occur. In 1915, outside of this area, which included northern Texas and southern Oklahoma, the "green bug" did occur locally in destructive abundance. Such outbreaks took place in Louisiana and South Carolina in grain fields. Much later in the season there was a totally unexpected and serious attack on the grounds of the department in Washington. Considerable areas of the bluegrass took on the peculiar reddish tinge so indicative of "green-bug" attack.

**HESSIAN FLY.**—One of the severest outbreaks in the history of the Hessian fly occurred during the spring of 1915 and covered most of the wheat-growing States. Starting in northern Oklahoma and Kansas, the infestation swept over the wheat belt northward and eastward, doing most of its damage, however, west of the Mississippi and north of the Ohio and Potomac Rivers. For a number of years all of the field stations located within the range of this pest east of the Rocky Mountains had observed the continued increase in numbers and had made unusual exertions to determine the cause of this increase. Nearly all attempts to rear parasites were without avail. The principal parasite was conspicuously absent from all rearings and the outbreak that followed was predicted. Several publications were issued during the year warning the farmers of an impending outbreak and giving them advice relative to the management of their fields in such a way as to reduce the damage. In the fall of 1914 it became quite evident that there would be much damage to the crop in the spring of 1915, and a number of men were engaged in watching carefully the results of preventive measures that had been applied, as well as the extent to which volunteer wheat entered into the problem of control. Early in June it became evident that unless something was done there would be a recurrence and perhaps even a more serious outbreak in the fall of 1915. To meet the overwhelming number of requests for information, Circular No. 51 was issued from the Secretary's Office. The first edition of 40,000 copies was soon exhausted and a second edition of 150,000 copies was printed. These have been distributed through the agency of county demonstrators and volunteer crop reporters from the different field stations located within the area covered by the threatened invasion.

**WIREWORMS.**—A bulletin was issued giving the more practical results obtained in the investigation of wireworms. Many experiments in soil fumigation were performed, but results require further verification before their practical value can be accurately determined. Cultural experiments were conducted in various States under different soil conditions. Some of these insects are of very slow development

and in consequence definite results can not be looked for, in some cases, for from 3 to 5 years.

**CLOVER-FLOWER MIDGE.**—Investigations of the clover-flower midge, taken up in western Oregon during the year, have been on the whole very satisfactory, and the evidence shows that the growers of clover seed may prevent attacks of this pest by properly timing the cutting of their clover-hay crop and in such a way as not greatly to reduce the yield.

**CLOVER-ROOT CURCULIO.**—When the clover-root curculio was first studied in 1909-10, it was not considered a very serious pest. It now transpires that for years there has been an obscure injury to alfalfa for which no one has been able to offer a satisfactory explanation. It has been attributed to soil conditions, cultural methods, and various other influences, and it is only within the last year that we have learned that this damage is probably largely if not entirely due to the attacks of the clover-root curculio on the roots of alfalfa. The larvæ feed on the roots not only of clover, but of the plant known as sweet clover (*Melilotus alba*). This is a roadside weed, and as red clover also occurs abundantly along the roadside throughout the northern section of the country, the control of the clover-root curculio in the alfalfa fields is greatly complicated.

**COWPEA INSECTS.**—Investigations of a number of insects attacking cowpeas were conducted as minor projects, but those relating to the cowpea *Cerotoma* and the attacks of its larva on the nitrogenous nodules of the plants constituted a major project. This work was conducted in cooperation with the Bureau of Plant Industry, and experiments were conducted on a large scale at the Arlington Farm. The object was to determine the effect upon the fertilizing value of the cowpea of the destruction of the nodules by the larvæ of the *Cerotoma*. Unfortunately this beetle seems to be more abundant, and its attacks on the nodules more serious, on the lighter lands where the fertilizing element of the cowpeas is most essential to the productiveness of the soil. The larvæ of the cowpea *Cerotoma* cause vastly more loss to the farmers than do the beetles.

**GRASSHOPPERS.**—During the year the bureau cooperated with the Kansas Agricultural Experiment Station in conducting an extensive campaign against grasshoppers, supervising the application of the poisoned bran bait over an area covering some 20 counties. In the work on the grasshopper problem of the Merrimac and Connecticut River Valleys it was found entirely practicable to destroy 95 per cent of the grasshoppers present over considerable areas at an expense of from 7 to 13 cents per acre by the use of a poisoned mixture. This work was carried on in pastures where stock was grazing continuously, but in no instances have any domestic or wild animals been injured. Similar results were obtained in Florida against a local grasshopper, and the farmers have made extensive use of the discovery.

**FALL ARMY WORM.**—During the year investigations conducted in a number of States showed conclusively that the fall army worm does not winter over north of extreme southern Texas and central or perhaps to some extent northern Florida. If the pest is controlled in these localities by its natural enemies, its spread to the north as the season



advances is numerically weak and little or no damage occurs, but if the natural enemies fail to exercise control in southern Texas and central Florida, the species becomes abundant and starts on its spread to the northward. The evidence is now conclusive that measures of practical control inaugurated in the Brownsville section of Texas and in central Florida exert an influence in preventing destruction throughout the territory to the northward.

**ALFALFA WEEVIL.**—The work on the alfalfa weevil consisted largely of experiments in control by the use of arsenicals, and in the establishment of European parasites. The results from the application of arsenicals were very satisfactory and it now appears that the principal work to be done on this topic is in the way of reducing the expense of the operation. Very careful attention was given to the possibility of the poisoning of stock, but it appears that the work can be done in such a way as to eliminate all danger. Progress was made in determining methods of pasturing which will also control the weevil. A system of inclosing sections of alfalfa fields with temporary fences and pasturing the live stock in one of these sections after another until the whole field is grazed was found to be effective, but certain questions relating to farm management have arisen in this connection which will require further attention. The European *Canidiella* parasite appears to have become fully established at five points in Utah. It is believed that this species will eventually exert considerable control over the alfalfa weevil.

#### INVESTIGATIONS OF INSECTS AFFECTING FORESTS AND FOREST PRODUCTS.

The work on insects affecting forest growth and crude and finished products has been continued under the supervision of Dr. A. D. Hopkins. Some of the subjects which received special attention were as follows: Insects affecting forest-tree seeds; damage to forest reproduction by pitch moths; relation of latitude, longitude, altitude, and local conditions to the distribution of forest-insect species, seasonal histories, and methods of control; relation of injuries by lightning to subsequent injuries to the forest by tree-killing insects; insects injurious to forest products; economic study of beneficial insects, and insect-control instructions and demonstrations in the national parks.

**INSECT DAMAGE TO CONES AND SEEDS OF PACIFIC COAST CONIFERS.**—Investigations show that insects cause practically an entire failure of the seed crop of conifers in certain localities of the Pacific coast in a single season. Among insects of this class are beetles which cause "blighted cones" and in some years the destruction or a great reduction over extensive areas of the seed crop of the two principal timber trees of the Pacific coast region. With the information now made available through publications, however, seed collectors will be able to find localities where full crops may be secured.

**SEQUOIA PITCH MOTH.**—It has been found that the Sequoia pitch moth is a menace to the reproduction pine in western Montana, especially in a certain area of more than 90,000 acres, but that it is practicable to control it by removing the conspicuous pitch masses on the young growing trees and destroying the young larvæ.

**DOUGLAS-FIR PITCH MOTH.**—The Douglas-fir pitch moth has been found to be the cause of great losses to the manufacturers of lumber in many localities through pitch seams, gum checks, or gum spots, and similar defects in otherwise clean stock of merchantable-sized trees, through its injury to young trees. Investigations show that a large percentage of this loss can be prevented in the future by removing the young larvæ from the bark of young to medium-sized trees. The investigator estimated that one man could clean and keep clean an area 50 miles square, or about 1,600,000 acres.

**EUROPEAN PINE-SHOOT MOTH.**—The European pine-shoot moth is a pest recently introduced in nursery stock from Europe. It has been found to be sufficiently established in nurseries, parks, and private grounds of some of the eastern States to be a serious menace to North American pines, but if the method recommended for its control is followed its injury can be greatly reduced.

**TERMITES.**—"White ants" or termites, which are exceedingly destructive to crude, finished, and utilized products in the Tropics, are also very destructive in the eastern and southern United States to the woodwork and contents of houses, including furniture, books, and papers, to poles and posts set in the ground, and to many kinds of crude and finished wood products. Extensive experiments and study of these insects have shown that a very large percentage of the losses which they are capable of causing can be prevented by treatment of the wood with chemical preservatives and by using the proper precautions in the construction of buildings.

**DEMONSTRATIONS.**—The success of the Klamath River instruction and demonstration project in the Klamath National Forest, Cal., which included privately owned timber, conducted in 1912 and 1913 and finally and thoroughly inspected during the past year, has furnished final and conclusive proof of the efficiency and economy of the percentage principle of control. This project involved a treated area of 32,400 acres and, including the adjacent untreated but infested area, a total area of 82,000 acres of yellow-pine timber where during the past 25 years more than 60,000 trees have been killed by *Dendroctonus* beetles. The treatment by felling and burning the bark of 1,098 infested trees, or about 27 per cent of the infestation of the entire treated and untreated area of 82,000 acres, resulted in a reduction of the infestation within the entire area of over 91 per cent below that in the area in 1911. This is considered a complete control. It has served to convince foresters and others who heretofore were skeptical as to the importance of the principle, and may be considered as one of the most important results of the year.

Since 1905 the demonstration and other control projects against the *Dendroctonus* beetles, carried on under specific recommendations or instructions, have involved the treatment of over 200,000 infested trees, representing over 40,000,000 board feet, on a total area of over 1,500,000 acres, at a cost to the Forest Service and private owners of about \$75,000, the cost per tree ranging from nothing to \$4, and in one case the treated timber sold and converted into lumber showed a balance to the credit of the owner of \$1.12 per tree. In no case was more than 75 per cent of the infestation of the treated and adjacent untreated areas removed. In fact, it is estimated that the aver-

age percentage was not over 40, yet in every case where the control work was done in accordance with the recommendations of this bureau marked reduction in the death of the timber followed, ranging from 75 per cent to 95 per cent below that of the year preceding the beginning of control work.

The instruction and demonstration against the *Dendroctonus* beetles in the national parks, inaugurated during the past year and carried on by the Interior Department under the instruction of an entomological ranger, was started in the Yosemite National Park and has been carried on with the most gratifying results to the bureau and the park officials.

MISCELLANEOUS.—Progress has been made in the work on the general projects, especially on the relation of latitude, longitude, altitude, and local conditions to insect life, which continues to show the great economic and broad application of a detailed knowledge of the subject. The investigation of beneficial insects in their relation to the natural control of destructive forest insects has yielded valuable results in showing how, in connection with the practice of the percentage principle of control, they may be protected and encouraged to render the best assistance to artificial control methods. A very large amount of new data and material has been collected during the year, represented by the records of observations on more than 30,000 specimens of reared insects, the collection of more than 20,000 specimens of insects and their work, and the identification of over 3,000 species, representing many thousands of specimens sent in by correspondents.

#### INVESTIGATIONS OF INSECTS INJURIOUS TO VEGETABLE AND TRUCK CROPS.

Investigations of insects injurious to vegetable and truck crops have been in charge, as heretofore, of Dr. F. H. Chittenden. The more important subjects of research during the year have been insects injurious to potato, sugar beet, and onion, the pea aphid, and insects affecting cruciferous crops, such as cabbage, turnip, and the like. During the course of the year investigations for which stations were established on Long Island and in Idaho have been completed, and the stations accordingly are not now occupied. Work has been temporarily discontinued in Arizona, and new stations have been opened in Michigan, Wisconsin, Louisiana, Mississippi, Kansas, and southern California.

ENEMIES OF POTATO AND RELATED PLANTS.—The potato-tuber moth, second only to the Colorado potato beetle as a pest, has been given continuous study in California. Studies of its life history and of its control by cultural methods have been completed, and the value of cold storage in checking the development in stored tubers has been demonstrated. In the field the species is being largely controlled by natural enemies, which have also been carefully studied. The Colorado potato beetle is continually widening its range, although slowly, southward and westward to the coast. In some sections it destroys entire crops unless spraying is practiced thoroughly. A report on the potato flea-beetle is forthcoming. The insect enemies of the tomato, as in past seasons, have been given a considerable



amount of study, and the results of the applications of lead arsenate and Paris green for the tomato fruitworm are available.

**SUGAR-BEET INSECTS.**—The false chinch bug has been studied for two years and a report is forthcoming during the year. Blister beetles, especially those which affect sugar beets as well as potatoes, were investigated in Kansas. In Colorado the sugar-beet webworm received continued study, and substantial progress was made. Large-scale experiments have definitely proved that this, one of the most important enemies of the sugar beet, can be easily controlled with arsenicals. Grasshoppers in their relation to sugar beets were studied in Kansas and a report has been completed. In previous years the beet leafhopper, which is the cause of the "curly top" condition, was locally extremely injurious and was investigated in the States of Utah, Idaho, and California. The study of its life history in Idaho has been completed and numerous experiments have been carried on in which its injury has been compared with that inflicted by other sugar-beet pests. Kerosene emulsion, nicotine sulphate, creosote compounds, and fish-oil soap have given negative results as sprays. Work is in progress in California and has been begun in Wisconsin. Sugar-beet wireworms have been the subject of experiments additional to those published in Bulletin No. 123 of the Bureau of Entomology, with the main idea of finding better and cheaper methods of control, including the use of various attractive baits.

**ONION INSECTS.**—Work on the onion thrips was continued during the year to make possible a report on its life history, especially in Indiana and southern Texas, as well as in other localities. The onion maggot, which feeds on the bulbs, was the subject of special investigation in Wisconsin from the standpoint of control measures, these being chiefly the use of repellents to prevent oviposition about the onion plants. Incidentally other root-maggots, including the seed-corn maggot and the barred-wing onion maggot, received attention.

**PEA APHIS.**—Investigations of the pea aphid were conducted in the States of Virginia, Michigan, Wisconsin, and California, at stations established there. New remedies were compared with old, and additional life-history studies, according to locality, were conducted. In connection with the pea aphid a comparatively unknown species, the pea mite, was studied in California.

**INSECTS AFFECTING CRUCIFEROUS CROPS.**—The cabbage looper was under continuous observation as in previous years, and a full report will soon be available. The cabbage maggot was the object of special study in Wisconsin and Michigan. The horse-radish flea-beetle and other flea-beetles received attention in different States, including Wisconsin, Colorado, and Kansas. Progress was made in the study of the western cabbage flea-beetle in Kansas, where this species is very destructive. Experiments with nicotine sulphate, fish-oil soap, and arsenicals, including arsenite of zinc, gave varying results in control, but arsenate of lead proved the most effective of all, its action being chiefly repellent. Excellent progress was made in investigations of the diamond-back moth, but some points require verification before a final report can be furnished.

**INSECTS INJURIOUS TO CUCURBITS.**—The melon aphid, the principal enemy of cucurbits in many portions of the country, was the subject

of considerable investigation. Plans were made for large-scale experiments with this pest in southern California and Texas. From the work conducted in Colorado it is evident that the natural enemies reared on rape for the control of this species on melons are of only slight benefit. A little-known bug which attacks squash after the manner of the common squash bug was studied in Louisiana, and the control of the cucumber beetles, especially the striped and belted species, was investigated in various localities.

**OTHER VEGETABLE, TRUCK, AND GARDEN INSECTS.**—It was definitely proved during the year that growers of strawberries can not be induced to use arsenicals against the strawberry leaf-roller where this injury comes immediately after the crop is harvested. They do, however, follow the advice of this bureau by replanting every other year and by burning over infested fields whenever injury has occurred, so as to prevent damage for the coming year.

The bean ladybird was investigated in Colorado and the bean leaf-beetle was under observation in Louisiana. The seed-corn maggot is prominent as an element destructive to early planting and was studied in different States as opportunity presented, as was the sweet-potato weevil and other sweet-potato insects.

Observations were made on garden slugs and snails, which do considerable harm to leaves, young seedlings of tomato, succulent plants, mushrooms, and plants grown under glass.

Demonstration work in the control of cutworms was conducted with excellent results and progress was made in the study of the life histories of some of the common as well as the less common species.

Progress was made at nearly all of the stations in the use of up-to-date sprayers. Thus, at the Kansas station, with a horse-drawn sprayer with centrifugal pump driven by a gasoline engine tested on 12 rows of sugar beets, the results were very encouraging. The self-propelled sprayer constructed for use in Texas in connection with onions was adapted for experimental work in the control of the melon aphid in commercial canteloupe fields, where the high pressure available promises unusual results.

#### INSECTS INJURIOUS TO STORED PRODUCTS.

Investigations of the insects injurious to stored products, especially grains and cereal products, such as flour and meal, and dried meats, fruits, beans, peas, seeds, and other foodstuffs, were continued under the direction of Dr. F. H. Chittenden.

Thorough observations were conducted on the so-called "Argentine weevil." The investigations were abandoned, however, on account of the fact that the importation of Argentine corn and other grain was practically stopped. The principal insect concerned is the rice weevil, and if importations had been continuous the probabilities are that this species would have been widely introduced into localities where it does not now occur. The same is true of the Angoumois moth, which ranks second in importance, and the rust-red flour beetle. These three insects were constantly being shipped northward, but it is too early to state whether or not they have gained a stronger foothold than formerly. Some minor insect pests, such as ham and hide

beetles, were also found in Argentine shipments. Upwards of 20 cargoes and many elevators were examined at the ports of Baltimore, New York, Brooklyn, and New Jersey. In many cases the grain had been held too long and was in unfit condition for seed or for human food.

A new pest, which attracted attention from its injuries to cacao in store, and to its products, such as cocoa and chocolate, was studied and an account of it will be available for publication shortly. Another insect which had previously been considered a scavenger was found to be very destructive in Mississippi and neighboring States to corn which has been left long in the field and taken in store, and a special investigation was started.

Fumigation with various chemicals, including three that are comparatively new for this purpose, was continued. One of these, paradi-chlorobenzene, was the subject of a special investigation.

What appears to be a new household pest in this country, although indications are that it may have been introduced 5 years earlier, was found in the District of Columbia, where it was quite destructive to upholstering, attacking especially the packing, which is chiefly of imported hogs' bristles. A building in which it was most abundant was successfully fumigated with hydrocyanic-acid gas.

The use of naphthalene balls as a means of preventing weevils from infesting stored corn, cowpeas, and other products was investigated, and the effect of heat and cold for the preservation of stored products was given special attention.

Work was conducted in California in the control of fruit insects by means of sealed paper cartons. The insects particularly concerned are the Indian-meal moth, the fig moth, the dried-fruit beetle, the saw-toothed grain beetle, and others. Several cartons were devised, as well as the proper methods of sealing each. The secret of preparing an insect-free package of dried fruit was shown to be sterilization at a temperature of 180° F. and protection from future infestation by the use of an insect-proof packing room and sealing in sterile cartons or packages.

#### INVESTIGATIONS OF INSECTS AFFECTING TROPICAL AND SUBTROPICAL FRUITS.

Mr. C. L. Marlatt continued in immediate charge of the bureau's investigations of tropical and subtropical fruit insects.

IMPROVEMENT IN METHODS OF FUMIGATION.—An important advance was made in fumigation methods. While the usual methods of destroying insects by fumigating with carbon bisulphid or hydrocyanic-acid gas have been found to be very effective in controlling certain insect pests, a reliable method of destroying insects likely to be present in plants and plant products imported from foreign countries has long been needed. This is especially true from the fact that the exclusion of insects at the port of export by any form of inspection is frequently impracticable.

In order to increase the diffusion of hydrocyanic-acid gas a fumigation chamber was constructed which would afford a partial vacuum, in the belief that a much larger amount of gas might thus be forced into the crevices of the material to be fumigated than would be possible if the gas were dependent upon diffusion under normal



atmospheric pressure. The initial experiments were conducted in a small fumigation chamber, 36 inches long by 12 inches in diameter. By the use of this chamber a number of different kinds of seeds and insects were fumigated successfully under a reduced pressure. In addition to the fumigation of seed, many tests were made with various deciduous plants, resulting in perfect control of the insects without injury to the buds.

In order further to test the penetration of hydrocyanic-acid gas in the presence of a partial vacuum, some 40 bales of Chinese, Peruvian, and Egyptian cotton were fumigated in a chamber containing 98 cubic feet. To determine the effect of the gas on insects at various points in these bales, steel tubes drawn to a point at one end, with small perforations at the small end, were driven into the bales to various depths. The insects were then suspended in these tubes in glass vials plugged with cotton, and the ends of the tubes extending outside of the bale were either sealed with a lead screw cap or with a rubber stopper sealed with glycerin. Under these unusual conditions it was found possible to destroy the larvæ and adults of the confused flour beetle and the rice weevil and larvæ of the bean weevil and the common clothes moth. The experiments conducted during the past year definitely proved that the efficiency of hydrocyanic-acid gas is greatly improved in the presence of a partial vacuum, and that this efficiency increases as we approach a perfect vacuum. The work gives a practicable method of control of certain insects which have hitherto been beyond reach, and will assist in a very important way in preventing the introduction of new pests.

**CITROUS-FRUIT INSECTS IN CALIFORNIA.**—The investigation of the citrus mealy bug, begun during the preceding year, was continued. In the life-history studies and methods of control satisfactory progress was made. Incidentally, various parasitic and predaceous enemies of these destructive insects were under observation.

Experimental work to determine the agencies responsible for fruit injury during the process of fumigating citrus trees with hydrocyanic-acid gas was carried on and definite data on this subject have been secured.

**CITROUS-FRUIT INSECTS IN FLORIDA.**—The investigations of insects affecting citrus fruit trees in Florida were continued, for the most part, along the lines indicated in the last annual report. It has been conclusively demonstrated that by the proper use of sprays the fruit output can be greatly increased and the quality much improved.

**CITROUS-FRUIT INSECTS IN LOUISIANA.**—The investigations of insects affecting citrus fruit trees in Louisiana progressed very satisfactorily. The Argentine ant was the subject of special investigations, and much information was gained on the amount of injury occasioned by this insect to citrus trees, and the possible methods of control. Methods of controlling the chaff scale and citrus white fly were also under consideration. Considerable information was secured on the biology of the fig borer, which at times occasions considerable injury to the fig trees.

**INSECTS AFFECTING DATE PALMS.**—The investigation of date-palm insects was brought to a conclusion in December, 1914, and the

laboratory at Mecca, Cal., closed. The life history of the date-palm scale has been worked out satisfactorily and its natural enemies well studied. Sufficient data have also been secured on the life history of the *Phœnicococcus* scale to aid materially in controlling this pest.

**MEDITERRANEAN FRUIT FLY.**—As indicated in the last annual report, the control and inspection of fruits shipped from the Hawaiian Islands to the mainland of the United States are conducted in cooperation with the Federal Horticultural Board. Life-history studies of the Mediterranean fruit fly from the standpoint of parasite introduction were conducted and the susceptibility of citrous fruits to fruit-fly attack was investigated. The life history of the melon fruit fly was thoroughly studied and a bulletin on this subject was issued. As in the past, intimate cooperation was maintained with the Territorial Board of Agriculture of the Hawaiian Islands in the introduction and establishment of parasitic enemies.

### WORK IN BEE CULTURE.

The work in bee culture, which remains in charge of Dr. E. F. Phillips, was greatly facilitated by the establishment of a field laboratory with the apiary at Drummond, Md., a suburb of Washington.

**WINTERING OF BEES.**—Again the principal work was the continuation of the investigation of bees in winter. The work was confined chiefly to bees wintered out of doors. Various methods of packing colonies were employed for the conservation of the heat generated by the bees, and, while certain differences were observable, it was found that in general the more completely bees are packed, the more nearly ideal conditions are approached. The choice of insulating material is of minor importance, since by using plenty of shavings, sawdust, or leaves the beekeeper can give the desired protection.

For the first time the wind velocities directly over the hives were recorded, and it was found that when a well-insulated colony is subjected to a wind of about 20 miles per hour, the beneficial effects of the insulation are virtually nullified. At the same time a careful record was kept of outside temperature, humidity, rainfall, and cloudiness. The effects of changes in temperature have been described in previous reports, and the investigation of the effects of other meteorological factors will be continued.

Several colonies were wintered in a specially protected room in the laboratory cellar, where the temperature was kept much higher than is usually considered desirable. The results obtained justify the conclusion that a cellar in which bees are wintered should have a temperature of at least 50° F. In conjunction with this work one colony was weighed hourly on specially constructed scales with the minimum disturbance, and it was found that when the temperature of the cellar was lowered the consumption of food was increased, which, of course, resulted in an increase in the feces accumulated, with their corresponding harmful results.

A study of the commercial hives in which insulation is retained throughout the year was undertaken, the object being to acquaint

manufacturers and beekeepers with the best methods of such construction.

DEVELOPMENT OF THE BEE.—The work on the development of the bee, which has been carried on for some time, was extended to include the anatomy of the larva and the changes incident to the accumulation of fatty tissue during growth. The rate of growth, the optimum temperature, and experimental production of abnormalities were under investigation, and as far as possible the behavior of the larva was observed.

ACTIVITIES OF BEES.—Further work on the rôle of the sense of smell was carried on, it having been previously determined that the organs of the sense of smell are located on the bases of the wings and legs and on other parts of the body, but not on the antennæ, as formerly supposed. Investigation of the sense of taste was also undertaken, the first step being a study of the structure of various sense organs located on the mouth parts.

DISEASES OF BEES.—The examination of samples of brood suspected of being diseased was continued, and an unusual number of such samples were received, indicating that the beekeepers over the country are being benefited by such work. The State inspectors of apiaries are continually sending in doubtful cases that can not be diagnosed in the field. The local inspectors are notified of each sample of disease received, and in this way they learn of many new outbreaks and can take prompt measures to bring them under control.

EFFECT ON BEES OF SPRAYING FRUIT TREES WHILE IN BLOOM.—Work begun in the spring of 1914 to ascertain the effect on bees of spraying fruit trees while in bloom was continued in cooperation with the Deciduous Fruit Insect Investigations of this bureau. Information as to the effects on bees of commercial spraying under various conditions was obtained, but the work so far has been helpful mainly in determining the best methods of making observations.





## REPORT OF CHIEF OF BUREAU OF BIOLOGICAL SURVEY.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF BIOLOGICAL SURVEY,  
*Washington, D. C., August 31, 1915.*

SIR: I have the honor to submit herewith a report on the work of the Biological Survey for the fiscal year ended June 30, 1915.

Respectfully,

HENRY W. HENSHAW,  
*Chief, Biological Survey.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### WORK OF THE BIOLOGICAL SURVEY.

During the year the work of the Bureau of Biological Survey was conducted along four principal lines: (1) Investigations of the food habits of North American birds and mammals in relation to agriculture, in charge of Dr. A. K. Fisher; (2) biological investigations with special reference to the geographic distribution of native animals and plants, in charge of E. W. Nelson; (3) supervision of national bird and mammal reservations, the preservation of native wild game, and the enforcement of the Lacey Act regulating the importation of birds and interstate shipment of game, in charge of Dr. T. S. Palmer; (4) administration of the Federal migratory-bird law, in charge of J. E. Mercer.

### ECONOMIC INVESTIGATIONS.

#### FUR-BEARING ANIMALS.

Considerable progress has been made in experiments in the domestication of fur-bearing animals during the past year. The numbers of fur bearers continue steadily to diminish as their haunts are opened up to agriculture and as they are hunted even in the most inaccessible regions. Trappers are stimulated by the high prices pelts usually command, and it becomes increasingly evident that, if the more valuable furs are to continue to serve as wearing apparel, the supply must be obtained chiefly through artificial propagation.

Investigations of problems connected with the domestication of minks and martens were continued at Prichard, Idaho; Linden, Md.; and the National Zoological Park, and have been concerned chiefly with types of inclosures, effects of different foods on the development

of young animals and growth of fur, effects of light on the color and durability of fur, molting, inbreeding, hybridizing between subspecies, importance of taming the animals, and the practical bearing of individual temperamental differences. The results of these experiments are already sufficiently encouraging to warrant an extension to other fur bearers, native and foreign, and the establishment in the near future of a well-equipped breeding station at some suitable point in eastern United States having a climate requisite for producing high-grade fur.

Experiments in handling and dressing pelts of the different kinds of fur bearers have been undertaken and are still in progress with a view to recommending, for those wishing to tan or dress furs, the method most satisfactory and involving the least labor and expense.

A number of moleskins from the northwest coast have been secured and dressed. In size, beauty, and durability they easily surpass skins of eastern and European moles and undoubtedly are destined to become popular. Although moles are small and have such habits that it is not feasible to breed them in captivity, where they are numerous they are worthy of the attention of trappers.

Investigation into the subject of silver fox farming has continued and a bulletin on the subject will soon be ready for distribution.

#### PRAIRIE DOG REPRESSION.

Increased work was carried on in national forests and on the public domain in the extermination of prairie dogs. This work has now been practically completed in the Pike, Leadville, and Cochetopa National Forests in Colorado, the Alamo National Forest in New Mexico, the Sevier National Forest in Utah, and the Wichita National Forest in Oklahoma, where more than 95 per cent of the prairie dogs have been destroyed and wide stretches of valuable grazing lands entirely cleared of them. While invasion from adjacent areas is likely to occur, very little effort will be needed to keep the cleared areas free of the pest.

Active campaigns against prairie dogs are being conducted on the Rio Grande Forest in Colorado, the Coconino and Sitgreaves Forests in Arizona, the Custer Forest in Montana, and the Sioux Forest in South Dakota. Important field operations and demonstrations have also been conducted in Texas, South Dakota, Oklahoma, Wyoming, Colorado, and Arizona.

Oats poisoned by a process whereby the bitter taste of strychnine is largely eliminated have consistently given the best results. Usually more than 85 per cent of the prairie dogs on infested areas are killed by the first application of the poisoned grain, and on the Pike, Sevier, and Wichita Forests over 95 per cent of the animals were destroyed. The only exception to this highly successful work is the Coconino Forest, where the abundance of a species of blue-stem grass, of which the animals are very fond, causes the prairie dogs to care little for grain of any kind. Poisoning operations of last summer in this forest were made less effective by an unusual amount of rain, and not over 70 per cent of the prairie dogs were destroyed in the poisoning and re-poisoning of the areas covered. During the year the work in the field has been so systematized that for the first time



the average cost of distributing poison on infested areas has been less than 5 cents per acre and re-poisoning operations have not exceeded a cost of 3 cents per acre.

#### GROUND SQUIRRELS ON NATIONAL FORESTS.

In the California, Monterey, Sequoia, Kern, and Modoc National Forests of California, the Toiyabe Forest of Nevada, and Sopris Forest of Colorado work in controlling ground squirrels was carried on, and experimental work was conducted on the Columbia ground squirrel in Idaho. Cooperative work with the North Dakota Agricultural College has resulted in perfecting methods for the control of the Richardson ground squirrel, which has long been a costly pest to grain growers of North Dakota. Very successful demonstrations were made in many parts of the State.

#### EXPERIMENTS AND DEMONSTRATIONS IN DESTROYING WOLVES.

Demonstrations and experiments were carried on in Colorado, Nevada, Texas, Idaho, Oregon, and other of the Western States with a view to the control of wolves and coyotes. In eastern Oregon and northern Nevada, where rabies prevails among coyotes, careful study was made of the conditions, and a considerable number of hunters employed to assist in destroying the coyotes with a view to eradicating the disease. In this work the bureau cooperated with the State authorities of Oregon. The results are encouraging, and of late no new cases of rabies have been reported, and there is a very noticeable decrease in the number of coyotes. Demonstrations in Texas were very effective, and many dens were discovered and the young animals destroyed. Future work contemplates much extended activity and the division of the area inhabited by wolves and coyotes into districts, each in charge of a competent inspector, who will supervise closely the operations of trappers and hunters.

#### POCKET GOPHERS.

Experiments in the Ochoco Forest of Oregon demonstrated the practicability of exterminating pocket gophers in National Forests. Campaigns were carried on in a number of localities within the area inhabited by these animals.

#### JACK RABBITS.

Demonstrations were carried on during the winter in Oregon, Washington, Idaho, California, Nevada, and Texas against jack rabbits, which were devastating the young orchards and forage crops, and many thousands of rabbits were destroyed.

#### MOLES.

During the year an assistant of the bureau has made extensive studies of the life history of the mole inhabiting the Northwest, where moles are so abundant as to be seriously destructive in meadows

and truck gardens. Demonstrations for the purpose of informing farmers as to the best methods of controlling the pest were carried on in many parts of the region.

#### MOUNTAIN BEAVERS.

The same general region is inhabited by an animal known as the "mountain beaver" or "sewellel," which, until recently, has been of little economic importance. Lately, however, these animals have extended their operations into cultivated areas and have destroyed raspberry and blackberry bushes and also farm produce. Preliminary experiments for their control were conducted.

#### PINE MICE.

The pine mouse of the Eastern States, owing to the destruction of its natural enemies, has greatly increased in numbers and not only destroys seeds but feeds upon sweet potatoes and other tubers and upon the roots of fruit and shade trees. Preliminary experiments and demonstrations were made for the control of this rodent.

#### CRAWFISH IN MISSISSIPPI.

Demonstrations of methods for destroying crawfish, so injurious in Houston clay lands of Mississippi and Alabama, were continued during the year. The methods that have been worked out have proven so successful that perfect stands of cotton were secured on land that had previously been heavily infested and the crops destroyed by these pests. It is estimated that after the first thorough treatment lands can be kept free from crawfish at an annual expenditure of not to exceed 25 cents per acre.

#### MORTALITY AMONG WILD DUCKS IN UTAH.

For several successive years large numbers of wild ducks and other waterfowl around Great Salt Lake, Utah, have died, apparently from some disease, the exact cause, however, being unknown. As the destruction of waterfowl amounts annually to many thousands, the pecuniary loss is very great. During the summer of 1914 an assistant of the bureau carried on field investigations in the Salt Lake Valley, continuing until the end of October. Undoubtedly all the species of ducks that habitually feed in shallow water are more or less affected, but during the summer's work only nine affected species came under observation. The loss among them was very great. In 1912 nearly 45,000 dead ducks were picked up on one marsh.

It is of interest to note that the fatality is by no means confined to ducks, but includes many species belonging to widely different families, as grebes, herons, shorebirds, avocets, and stilts. The trouble during the present year began in July and terminated about September 20. The birds affected seem partially paralyzed, losing the power of flight, and gradually weakening until they die. The first clue to the nature of the trouble was obtained when it was found that affected ducks generally recover readily when given fresh water, and of 586 so treated in experimental pens 426 were entirely cured.

Further experiments and observations seem to prove beyond a reasonable doubt that the trouble arises from the presence in the water of an alkali that is absorbed through the alimentary canal in fatal quantities.

It was ascertained that a similar trouble exists at Tulare Lake, Cal., and results there also in the death of many waterfowl. An assistant engaged in the work visited this locality in November in order to study local conditions. A report on the progress made was published in May.

#### DESTRUCTION OF OYSTERS BY CERTAIN WILD DUCKS.

Examination of stomachs of wild ducks secured from near Olympia, Wash., definitely supported a charge that certain scaups and scoters were doing considerable damage locally to oyster beds. During the ducking season of 1914-15 investigations were carried on by an assistant of the Survey on the headwaters of Puget Sound and the whole of Willapa Harbor, and noteworthy damage was found to be confined to a single bay—Oyster Bay—18 miles northwest of Olympia, Wash.

Two species of ducks—the greater scaup, or bluebill, and the white-winged scoter, or coot—were found to be doing all the damage. The average numbers of these birds present on Oyster Bay during the season were 2,000 and 300, respectively. An estimate (subject to revision) was made that these ducks were destroying about 8,000 oysters daily, the money value of which would be \$20. This would amount to about \$3,600 for the duck season. Effective measures for relief are in force.

#### FOOD OF WILD DUCKS.

The work of the bureau in acquiring and disseminating information regarding the propagation of plants best suited for wild-fowl food has been greatly appreciated by game protective associations and individuals interested in the preservation and propagation of native wild fowl. In response to requests for information of this nature, a third publication in the series on important wild-duck foods was issued in May. This bulletin treats of 11 groups of plants, including 2 fresh-water plants of wide distribution in the United States; 2 of more southerly range; 2 trees of southern swamps whose abundant seeds are eagerly eaten by ducks; 1 strictly salt-water duck food, the first thus far recommended by the bureau; 1 brackish-water plant; and 3 others of such luxuriant growth as to be especially adapted for use on duck farms.

#### THE EUROPEAN STARLING.

The European starling, an introduced species, continues to increase in numbers and to occupy new territory. Reports of the bird's activities are somewhat conflicting. That it is to some extent beneficial is proven by its destruction of insects, especially in summer. In some localities, however, it is charged with the destruction of small fruit, and unquestionably its presence in numbers is inimical



to our native species that build in tree cavities and boxes, as wrens, martins, swallows, and flickers; and with these it is brought into direct competition. A circular has been widely distributed for the purpose of eliciting information as to the extent of territory the starling now inhabits and as to the amount of damage the bird inflicts on fruit.

Information on the economic importance of the bird has been sought during the year by means of letters and by the collection of stomachs. It is planned to carry on field investigations of the starling as soon as possible with a view to determining its status in the United States.

#### ATTRACTING BIRDS.

Bird lovers throughout the land are seeking ways and means of increasing the number of birds and of attracting them to the vicinity of homes. While the basis for this movement is in part esthetic, to no small degree such efforts are based on a growing appreciation of the usefulness of birds as insect destroyers. The increase of interest in wild birds throughout the United States during the past decade has been phenomenal, and organizations having for their chief object the care and protection of birds are numbered by hundreds, if not thousands. Civic leagues and women's clubs have been especially active in attempts to attract birds to city parks and suburbs, with a view to bringing wild life to the doors of those denied the privilege of knowing it in wilder districts. Two publications issued during the year designed to aid and advance this movement—"Bird Houses and How to Build Them" and "How to Attract Birds in North-eastern United States"—constitute manuals on the means of attracting birds and fill a widespread and continually growing demand. The bulletin discussing methods of attracting birds is the first of a series planned to cover all sections of the United States. Special attention is given to the kinds of fruit-bearing shrubs and trees important as furnishing food for birds.

#### ECONOMIC STATUS OF CERTAIN IMPORTANT SPECIES.

Examination of bird stomachs by groups was completed for mallards, wrens, thrashers, mocking birds, catbirds, chickadees, and titmice. In the case of cuckoos, crows, and jays the examinations were brought up to date. Intensive study of the common crow is being made with a view to supplying precise information as to its economic status.

In a publication issued in July on birds in relation to the alfalfa weevil it was shown that 45 species of birds prey upon this pest. Economic investigations of food habits of birds resulted in a bulletin on the food of the robins and bluebirds of the United States, and a revision, under the title "Some Common Birds Useful to the Farmer," of an earlier Farmers' Bulletin (No. 54) which has had a larger circulation than any other publication on American birds. Reports on the food habits of thrushes of the United States, on the birds of Porto Rico, and on some common birds of southeastern United States will soon be published.

## BIOLOGICAL INVESTIGATIONS.

Biological investigations have been mainly along lines which supply information essential to the effective administration of the various activities of the bureau, including the enforcement of the Lacey Act regulating importation and shipment of game, the Federal migratory-bird law, maintenance of bird and mammal reservations, and economic investigations concerning the relations of birds and mammals to agriculture, stock-growing, and forestry. In securing information of practical value in connection with the conservation of our bird and mammal life, particularly in regard to the species of economic importance, a card-index file, consisting largely of unpublished data gathered by the field parties of the bureau, has been greatly increased. Manuscript field notes on mammals gathered during the past 25 years have been arranged in the card files, and for the first time have become readily available for reference. The files concerning North American birds now contain more than 1,000,000 cards.

## DISTRIBUTION AND MIGRATION OF BIRDS.

Regular reports on the migration of birds have been received during the year from all parts of the United States from more than 300 volunteer observers and some from Canada and Alaska. These furnish invaluable records in connection with the administration of the migratory-bird law. Office investigation has included the collation and preparation for publication of material concerning the distribution and migration of gulls, terns, and rails and their allies and several other groups of birds. As rapidly as possible facts gathered in investigations of bird migration are being published that the information may be available for the use of those interested, particularly in connection with the formulation of laws for the protection of birds by the various States.

## BIRD CENSUS.

The data secured by the first bird census, made in the spring of 1914, were studied and a preliminary report prepared and published. The results proved of extreme interest and showed the possibility of largely increasing the bird life throughout the country. A second national bird census was announced for the spring of 1915, and more than 200 voluntary observers took part in it, covering the country more generally than in the preceding year. The results of this work also will be prepared for publication. One of the most valuable facts developed by the bird census was that where an effort is made to protect birds from their enemies there is a notable increase of the bird population.

## DISTRIBUTION MAPS OF BIRDS AND MAMMALS.

Work was continued on the preparation of distribution maps showing the area occupied by each species of bird and mammal in North America. A set of distribution maps of certain economically important birds and mammals was completed and is being exhibited at the Panama-Pacific International Exposition at San Francisco. Maps showing the present and former ranges of the various species of game birds and mammals have proven extremely useful in connection with restocking areas in which the various species have become extinct.

## DISTRIBUTION MAPS OF PRAIRIE DOGS.

During the first part of the year work was continued platting in detail the distribution of prairie dogs over a large area in eastern Arizona. This demonstrated that prairie dogs are rapidly extending their range and travel surprisingly long distances to locate new colonies, a few individuals being found sometimes from 6 to 8 miles from the nearest inhabited prairie-dog area. This shows the necessity for destroying scattered colonies of these pests in order to prevent rapid occupation of great areas of new country.

## BIOLOGICAL SURVEYS.

Progress was made on the biological surveys of Oregon and North Dakota, in cooperation with local institutions. The survey of Alabama was nearly completed and a considerable advance made on that of Arizona. A final report with map on the biological survey of Wyoming was prepared for publication, and reports on the birds and mammals of New Mexico, based on the survey of that State, were nearly completed.

## INVESTIGATIONS OF LARGE GAME ANIMALS.

Special attention is being paid to securing information and specimens for study concerning the large game animals of North America. The need of this is emphasized by the rapid decrease of certain species and their extermination throughout large areas where once they were plentiful. The bureau has had the active cooperation of a number of men who have visited remote districts in the United States, Canada, and Alaska for the purpose of securing information and specimens of large game, which they have freely contributed to the bureau. These expeditions have been made at the personal expense of the collaborators and the results secured have been of great value.

## INVESTIGATIONS RELATING TO MIGRATORY WILD FOWL.

In connection with the administration of the migratory-bird law an investigation is being made of the food plants of wild fowl in their haunts, and at the same time of the present status of migratory species in various parts of the United States. The results, published together, will form an invaluable stock of information for use in connection with measures taken to increase the food supply of our wild fowl and otherwise to conserve this valuable national asset.

## TECHNICAL INVESTIGATIONS.

A large number of birds and mammals were identified on request of State and other institutions and individuals throughout the country. A monograph of the marmots was published and technical studies of North American moles and pocket gophers were completed. Much work also was done on other groups of mammals, concerning the number of species of which and their relationships little was known.



## GAME PRESERVATION.

## NATIONAL BIRD RESERVATIONS.

Four national bird reservations were established during the past year—Dungeness Spit and Ediz Hook in Washington, Mille Lacs in Minnesota, and Blackbeard Island in Georgia—making a total of 70 reservations set apart to date, of which 67 are now in charge of the department. Recently it was deemed advisable to relinquish Blackbeard Island, and accordingly, on May 25, 1915, the order establishing this reservation was vacated by order of the President. With few exceptions conditions on most of the reservations where warden service is maintained during whole or part of the year have been very favorable for the increase of bird life.

**DEER FLAT, IDAHO.**—The warden stationed at this reservation reported on June 16, 1915, that he had discovered 50 pairs of pelicans nesting, the first time these birds have been known to breed there. Several species of ducks breed on or near this reserve, and this number will, no doubt, be considerably augmented in the future. The prime value of the reservation in the cause of bird protection is the refuge it affords to the thousands of ducks, geese, swans, pelicans, and other birds stopping here to rest and feed during migration.

**FORRESTER ISLAND, ALASKA.**—The bureau continues to maintain warden service on this reservation during the fishing season. The warden estimates that more than a third of a million water birds breed on the island, the species most numerous being the tufted puffin, rhinoceros auklet, ancient murrelet, California murre, glaucous-winged gull, forked-tailed petrel, and Kaeding's petrel, the last species numbering 100,000.

**ANAHU ISLAND, NEV.**—In the first official investigation of this reservation by an inspector of the bureau, in October, 1914, 29 species of birds were noted. The more common were the Farallon cormorant, coot, western meadowlark, and house finch. Pelicans, which also inhabit the island, had migrated at the time. Formerly Indians belonging to the Pyramid Lake Reservation, as well as tourists, raided the island during the nesting season and collected large quantities of pelican eggs. Warden service is now maintained during the nesting season.

**SMITH ISLAND, WASH.**—This reservation, comprising Smith and Minor Islands, is important as a refuge for thousands of brant during their migratory flights. Heretofore large numbers of these birds were illegally killed by hunters in power boats. Through the cooperation of the lighthouse keeper the birds are now unmolested.

**EAST PARK, CAL.**—While investigating conditions on this reservation in March the inspector received information that at least a thousand swans had died in the vicinity of a 20-acre lake owned by the Butte Country Club near Live Oak, in the adjacent county. His report states that the lake is fed from the overflow of rice fields which have little water in them during early winter before the rainy season sets in. Late in January the swans sickened and in February many died. The cause of the mortality was not ascertained.

**HAWAIIAN ISLANDS RESERVATION.**—Through cooperation with the Treasury Department, officers of the United States Coast Guard cutter *Thetis*, stationed at Honolulu, made an investigation of the islands comprising this reservation, covering a period from March 18 to April 3. So far as noted the conditions of bird life on Bird Island, French Frigate Shoals, Laysan, and Ocean Islands were normal, and there were no indications that the birds inhabiting these islands had been disturbed. On Laysan Island, however, it was discovered that poachers had been at work and that between 150,000 and 200,000 birds, consisting of the black-footed albatross, frigate bird, black-faced booby, and the Laysan albatross, chiefly the last-named species, had been killed for their plumage, the breast feathers only being taken. Apparently the smaller species were not disturbed, including the little colony of Laysan teal. The bird life of Laysan through this depletion is by no means wiped out, and no doubt in a comparatively short time will regain its normal strength, provided it can be protected from the atrocities of poachers. Owing to the remoteness of the islands and the cost of establishing a permanent warden service there, the protection of the reservation is exceedingly difficult. So far the department has been compelled to rely chiefly for the protection of the colonies on occasional visits of the Coast Guard cutter *Thetis*, which the Treasury Department has generously detailed for this service when possible.

**KLAMATH LAKE, OREG.**—After several years of negotiation practically all private holdings of land have been eliminated from the reservation. These eliminations do not in any way affect its value as a breeding place and refuge for bird life. Conditions on the reservation have been favorable, with the exception that on May 5 a tule fire burned from Midland south along the railroad grade to the straits and halfway to the lower lake, destroying many young geese, large numbers of ducks' nests, and young mink.

**LAKE MALHEUR, OREG.**—The warden in charge of this reservation has been furnished a new steel-frame rowboat and also a motorcycle, that he may more adequately patrol this very important bird reservation. Large numbers of waterfowl here find breeding and feeding places, as well as a safe refuge.

**RESERVATIONS IN FLORIDA.**—With but few exceptions, conditions on the various bird reservations in Florida remain favorable, and bird life is increasing. On Bird Key, Tortugas, it is estimated by experts who visited the island in May, that at the end of the hatching season there will be between 115,000 and 120,000 sooty and noddy terns on the rookeries. At Matlacha Pass thousands of Louisiana herons nested, and on other reservations as well this species seems to be increasing satisfactorily. At Indian Key there is a marked increase of all forms of bird life, and the reservation is growing in importance. On Passage Key fully 50 per cent of the birds were destroyed by a severe tornado which visited the island on June 9, uprooting many high trees; herons which nest in the tops of the trees suffered more severely than other birds.

#### MONTANA NATIONAL BISON RANGE.

An addition of 21 calves born during the past year brings the total number of bison now on the National Range to 137. The herd is in excellent condition. Elk and antelope continue to do well;

several young have been born, and the elk now number about 30 and the antelope 13. An unusually heavy rainfall during the spring has resulted in the heaviest growth of forage since the range was established. Fences have been kept in repair, irrigation ditches improved, and all other work necessary to the proper maintenance of the range carried on.

#### WIND CAVE NATIONAL GAME PRESERVE.

The work of properly maintaining the Wind Cave preserve is now being carried on in a satisfactory manner, and a permanent warden has been appointed through civil-service examination. The construction of an 88-inch woven-wire fence, 8.67 miles in length, was completed in November, inclosing 4,160 acres of land. Through the generosity of the Boone and Crockett Club 13 antelope were added to the preserve on October 18, the animals, in charge of an agent of the bureau, being shipped without loss or injury from Brooks, Alberta, Canada. Since the last annual report the number of buffalo was increased by the birth of 4 calves. The total number of animals now on the preserve is 40—16 buffalo, 9 antelope, 14 elk, and 1 deer. Losses by death during the year were 2 buffalo (including 1 calf), 3 elk, and 4 antelope. The condition of the remaining animals is excellent, and the outlook for an interesting and valuable preserve is encouraging.

#### NIOBRARA GAME RESERVATION.

By reason of its advantageous location, the Niobrara preserve gives promise of becoming one of the most important under the supervision of the bureau. The continued large number of visitors to the preserve during the summer months—3,563 during the calendar year—indicates that so far as public interest is concerned no mistake was made in its establishment as a bird reservation and game preserve. Conditions continue to improve and the warden in charge reports excellent prospects for harvesting a good crop of grain and hay to feed the animals. During the year 1 buffalo and 7 elk calves were born. The animals now number 41, and comprise 11 buffalo, 28 elk, and 2 deer, all in good condition. As they become more accustomed to their surroundings the animals will, no doubt, increase rapidly. Losses reported during the past year included the death of 1 male elk calf during the severe winter, and 2 deer—a doe and a buck, the doe being killed by lightning and the buck dying from unknown causes. There are now 7 Canada wild geese, 4 having been lost, 2 by escape from the reservation and 2 by death during the winter. The unusually stormy winter caused the loss of nearly all the pheasants.

#### WYOMING ELK REFUGE.

With the purchase of a tract of land in Jackson Hole, consisting of 1,240 acres (known as the Miller Ranch), preparations were made at once for active work at the Wyoming Elk Refuge. An agent of the bureau was put in charge, and necessary maintenance equipment, including a team of horses, was purchased. Negotiations are in progress for the purchase of an additional 520-acre tract, which, with the 840 acres of vacant public lands already set apart for this refuge, will make a total of 2,600 acres. Sufficient hay land is thus secured to insure a crop for feeding a large number of elk during the winter.



## FEEDING AND TRANSPORTING ELK.

For the first time since the Government has undertaken the work of feeding elk in the Jackson Hole region, Wyoming, the winter in that section was so mild that elk did not migrate to the feeding grounds. Consequently feeding was unnecessary, and, as there was no chance of capturing animals for transportation, no shipments from this region were made. The elk came down no farther than the foothills, and by March 1 practically all had returned to the mountains. The losses resulting from "winterkilling" were, therefore, below normal, but about the usual number are estimated to have been killed by wolves during the winter months. Through cooperation with the Department of the Interior and the Forest Service, 75 elk from the Yellowstone National Park were shipped under the supervision of an agent of the bureau—25 to Utah and 50 to Colorado.

## IMPORTATION OF BIRDS AND MAMMALS.

War conditions in Europe have resulted in a very noticeable falling off in the importation of birds and mammals. Only 454 permits were issued during the year, a decrease of 75 from 1914. The inspections numbered 150, as against 211 in 1914, and only 270,050 birds and 3,463 mammals were imported under permit. Among these were 216,037 canaries, 7,080 partridges, 15,841 pheasants, 5,345 miscellaneous game birds, and 25,747 nongame birds. Besides these, 46,095 birds and 104 mammals requiring no permits were admitted to entry, making a total of 316,145 birds and 3,567 mammals. At Honolulu only 37 permits were issued, for the entry of 191 birds, principally parrots. Two cases of entry of prohibited species were reported during the year: One mongoose, consigned to Prospect Park, Brooklyn, N. Y., was refused entry at the port of Philadelphia in November, and another, which had been inadvertently admitted from Calcutta, was discovered in San Francisco and reexported in January.

The issuing of permits for the importation of quail from Mexico was resumed November 1, 1914, under regulations which require the birds to be held in quarantine for a certain period at the port of Brownsville, Tex., the quarantine regulations being under the supervision of inspectors of the Bureau of Animal Industry. On January 6, after 3,341 quail had been permitted entry, disease was discovered by the inspectors and further importations were suspended. An investigation made by the Survey showed that of the total number of birds imported from Mexico about one-third died from disease. It is expected to resume issuing permits for the entry of quail from Mexico about November 1, 1915, under certain quarantine regulations.

## INTERSTATE COMMERCE IN GAME.

During the year there were reported to the solicitor's office 27 cases of violations of sections 242, 243, and 244 of the criminal code, known as the "Lacey Act," relating to interstate traffic in game. These involved violations of law in the States of Arkansas, Delaware, Indiana, Iowa, Kentucky, Michigan, Mississippi, Missouri, Tennessee, Virginia, West Virginia, and Wisconsin.

The cases now pending in court number 37 and those under investigation, 38. In one case pending in Missouri evidence was ob-

tained disclosing a systematic plan to violate the law in shipping ducks to market in the adjoining State of Illinois. The evidence showed not merely a violation of the Lacey Act, but a conspiracy to accomplish the shipment of ducks out of the State, and the shippers were so charged. This is one of the most important cases which has developed under this act, and the first in which evidence of a conspiracy has been obtained. In the event of a conviction the deterrent effects are likely to be far-reaching.

Recent occurrences in Arkansas, one of the most important centers for the shipment of waterfowl in the Mississippi Valley, are likely to curtail very decidedly future shipments of game from the sunken lands in the northeastern corner of the State. The State supreme court has decided that a local law applicable to Mississippi County, under which shipments of waterfowl have hitherto been made, was unconstitutional, and that the State law prohibiting export of game was applicable to the counties generally. At the recent session of the legislature provision was made for the first time for the appointment of a State game commission to enforce State laws.

The State of Illinois has also amended its game law prohibiting sale of game, whether taken in or out of the State, thus closing the important market of Chicago. These changes will greatly facilitate the work of the department in the Mississippi Valley and make much more difficult the evasion of State and Federal laws regulating shipment of waterfowl.

#### INFORMATION CONCERNING GAME LAWS.

The index to game legislation has been kept up to date and memoranda of the important game laws prepared. The annual directory of game officials and the summary of game laws for 1914 were issued, and also four sets of ready-reference card maps containing information in condensed form of particular interest to various State game officials.

#### FEDERAL MIGRATORY BIRD LAW.

Under the Federal migratory-bird law, approved by the President March 4, 1913, the regulations fixing close seasons on migratory game birds were prepared and promulgated October 1, 1913, and amended October 1, 1914. During the year the number of district inspectors was increased from 15 to 17, and the warden force from 172 to 196. Cooperation with the game departments of most States has resulted in the better enforcement of State laws and Federal regulations. Since the law went into effect 470 alleged violations have been reported by district inspectors and Federal wardens, but in many cases the evidence was too meager to justify prosecution; 53 cases have been referred to the Department of Justice for action; fines were imposed in 12 cases, 9 cases were dismissed, and the remainder are still pending. In two United States district courts the law has been held unconstitutional: (1) In the eastern district of Arkansas, May 1914, in the case of *United States v. Harvey C. Shauver*, charged with violating Regulation No. 9; and (2) in the district of Kansas, on March 20, 1915, in the case of *United States v. George L. McCullagh*, charged with violating the same regulation.

That the violations reported by no means approximate the number that have occurred is to be expected and is due to the impossibility, in many cases, of procuring evidence sufficient to convict. Inspectors and wardens appointed under authority of this law have no power of arrest or search, and hence many violators escape. A further difficulty is that the limited number of inspectors necessitates unduly large districts, some of them difficult of effective patrol.

As the activities of the inspectors have been confined mainly to "trouble zones," very large sections have necessarily been left without supervision, but in such instances State authorities, cooperating with Federal wardens, have rendered efficient assistance. The law has proven exceedingly popular with the people at large, and with a considerable percentage of sportsmen. During the course of the year the bureau has received a large number of petitions, requests, suggestions, and protests touching various regulations, chiefly urging longer seasons and spring shooting. All of these will receive careful attention when amendments or changes of the present regulations are considered. With a few notable exceptions, the State legislatures, 43 of which have been in session this year, have made progress in line with the Federal law and regulations.

Notwithstanding many violations of the regulations in different sections of the country, the law was generally observed by sportsmen, and as a consequence chiefly of the cessation of spring shooting waterfowl and shorebirds passed to their northern breeding grounds in greater numbers than for many seasons. The general observance of the prohibition of spring shooting resulted also in the breeding of many thousands of ducks in certain localities where they have not nested for many years. These results following the enforcement of the law are an earnest of the results to come.

### PUBLICATIONS.

Publications during the year, in addition to miscellaneous circulars and announcements, arranged by the division preparing them, were as follows:

#### ECONOMIC INVESTIGATIONS.

##### Department Bulletins:

- No. 107. Birds in Relation to the Alfalfa Weevil.
- No. 171. Food of the Robins and Bluebirds of the United States.
- No. 205. Eleven Important Wild-Duck Foods.
- No. 217. Mortality Among Waterfowl Around Great Salt Lake, Utah.

##### Farmers' Bulletins:

- No. 609. Bird Houses and How to Build Them.
- No. 621. How to Attract Birds in Northeastern United States.
- No. 630. Some Common Birds Useful to the Farmer.
- No. 670. Field Mice as Farm and Orchard Pests.

#### BIOLOGICAL INVESTIGATIONS.

##### North American Fauna:

- No. 37. Revision of the American Marmots.

##### Department Bulletins:

- No. 128. Distribution and Migration of North American Rails and Their Allies.
- No. 185. Bird Migration.
- No. 187. Preliminary Census of Birds of the United States.

##### Yearbook Separate, 1914:

- No. 642. Our Shorebirds and Their Future.



## GAME PRESERVATION.

Farmers' Bulletin:

No. 628. Game Laws for 1914.

Biological Survey Document:

Directory of Officials and Organizations Concerned with the Protection of Birds and Game, 1914.

Reports now in process of publication or partially completed include a report on the Birds of Porto Rico; North American Faunas on Revisions of American Moles, of Pocket Gophers, of Prairie Dogs, of Rice Rats, on the Biological Survey of Wyoming, and on the Birds of Texas; Department Bulletins on Silver Fox Farming, Food Habits of Thrushes and of Swallows, and on the Distribution and Migration of North American Gulls and of Terns; and Farmers' Bulletins on How to Attract Birds in Northwestern United States, Habits and Economic Status of Southern Birds, of Pocket Gophers, of Cottontail Rabbits, and of Wolves and Coyotes.



## REPORT OF THE CHIEF OF THE DIVISION OF ACCOUNTS AND DISBURSEMENTS.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
DIVISION OF ACCOUNTS AND DISBURSEMENTS,  
*Washington, D. C., September 21, 1915.*

SIR: I have the honor to submit herewith a report of the work of the Division of Accounts and Disbursements for the fiscal year ended June 30, 1915.

Respectfully,

A. ZAPPONE,  
*Chief of Division.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### CHARACTER OF WORK.

The chief of the division and disbursing clerk is charged by the Secretary of Agriculture with the duty of preparing all requisitions for the advance of public funds from the appropriations for the Department of Agriculture to disbursing clerks and special disbursing agents charged with the disbursement of public funds; the keeping of appropriations ledgers relating to the advance and disbursement of all items of appropriations; and the payment of all vouchers and accounts submitted from the various offices, bureaus, and services of the department. He performs such other duties as may be prescribed by the Secretary.

### WORK OF THE YEAR.

#### APPROPRIATIONS, EXPENDITURES, ETC.

To carry on the work of the Department of Agriculture during the fiscal year ended June 30, 1915, Congress appropriated \$19,865,832 for ordinary expenses, in addition to which permanent annual appropriations, special appropriations, deficiency appropriations, and the appropriation for printing and binding were available amounting to \$10,628,008.64, making a total of \$30,493,840.64, of which sum \$20,162,933.15, was disbursed prior to the close of the year, leaving a balance of \$10,330,907.49, which is nearly all covered by outstanding liabilities.

Supplemental accounts for the year 1914 were also paid, amounting to \$1,196,627.98.

The unexpended balances for the year 1913, amounting to \$690,478.72, were finally covered into the Treasury on June 30, 1915, to the "Surplus Fund."



There were received, examined, and paid by this office 127,460 accounts, which required the issuance of 223,684 checks on the Treasurer of the United States.

There were also sent to the Treasury Department for payment 3,661 accounts.

#### LOST CHECKS.

During the year 152 checks were lost in transit through the mails or by the payees, and were duplicated by this office.

#### PUBLIC MONEYS RECEIVED FROM VARIOUS SOURCES.

There were received from various sources and deposited in the Treasury to the credit of the proper funds the following sums:

Miscellaneous receipts, sales of condemned property, etc.....	\$80,499.99
Sales of products, agricultural station, Hawaii.....	281.04
Sales of products, agricultural station, Porto Rico.....	2,110.65
Sales of products, agricultural station, Alaska.....	1,089.01
Sales of products, agricultural station, Guam.....	213.30
Total.....	84,193.99

STATEMENT OF APPROPRIATIONS, DISBURSEMENTS, AND UNEXPENDED BALANCES  
FOR THE UNITED STATES DEPARTMENT OF AGRICULTURE.

Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
1839..	\$1,000.00	\$1,000.00	-----	1879..	\$206,400.00	\$206,360.00	\$40.00
1840..	-----	-----	-----	1880..	199,500.00	198,361.72	1,138.28
1841..	-----	-----	-----	1881..	275,460.31	267,608.84	1 7,851.47
1842..	1,000.00	1,000.00	-----	1882..	363,011.05	354,482.39	2 8,528.66
1843..	-----	-----	-----	1883..	456,396.11	438,941.72	3 17,454.39
1844..	2,000.00	2,000.00	-----	1884..	4 416,641.10	413,618.09	3,023.04
1845..	2,000.00	2,000.00	-----	1885..	6 555,930.25	558,934.89	6 96,995.36
1846..	3,000.00	3,000.00	-----	1886..	6 677,973.22	519,196.11	158,777.11
1847..	3,000.00	3,000.00	-----	1887..	6 657,641.81	628,287.14	29,354.67
1848..	4,500.00	4,500.00	-----	1888 6	1,027,219.06	1,011,282.62	15,936.44
1849..	3,500.00	3,500.00	-----	1889..	4 1,134,480.60	1,033,590.22	7 100,890.38
1850..	5,500.00	5,500.00	-----	1890..	4 1,170,139.11	971,823.62	8 198,315.49
1851..	5,500.00	5,500.00	-----	1891..	4 1,372,049.21	1,266,277.36	105,771.85
1852..	5,000.00	5,000.00	-----	1892..	4 2,303,655.75	2,253,262.29	50,393.46
1853..	5,000.00	5,000.00	-----	1893..	2,540,060.72	2,355,430.25	184,630.47
1854..	10,000.00	10,000.00	-----	1894..	2,603,855.58	1,977,469.28	9 626,386.30
1855..	4 50,000.00	50,000.00	-----	1895..	2,506,915.00	2,021,030.38	485,884.62
1856..	30,000.00	30,000.00	-----	1896..	2,584,013.22	2,094,916.42	489,096.80
1857..	75,000.00	75,000.00	-----	1897..	2,448,763.53	2,348,512.98	100,250.55
1858..	63,500.00	63,157.25	\$342.75	1898..	2,467,902.00	2,425,510.44	42,391.56
1859..	60,000.00	60,000.00	-----	1899..	2,829,702.00	2,827,795.65	28,906.27
1860..	40,000.00	40,000.00	-----	1900..	3,006,022.00	2,947,603.42	58,418.58
1861..	60,000.00	60,000.00	-----	1901..	3,304,265.97	3,239,137.39	65,128.58
1862..	64,000.00	63,704.21	295.79	1902..	3,922,780.51	3,902,675.79	20,104.72
1863..	80,000.00	80,000.00	-----	1903..	5,015,846.00	4,734,230.84	281,615.16
1864..	199,770.00	189,270.00	10,500.00	1904..	5,025,024.01	4,969,311.64	55,712.37
1865..	112,304.05	112,196.55	107.50	1905..	5,894,540.00	5,820,204.00	74,336.00
1866..	167,787.82	167,787.82	-----	1906..	6,225,690.00	6,029,510.02	196,179.98
1867..	199,100.00	199,100.00	-----	1907..	9,505,484.74	9,025,318.93	1,200,165.81
1868..	279,020.00	277,094.34	1,925.66	1908..	11,487,950.82	11,045,412.19	442,538.63
1869..	172,593.00	172,593.00	-----	1909..	15,385,806.00	15,079,472.29	306,333.71
1870..	156,440.00	151,596.93	4,843.07	1910..	15,958,811.27	15,547,983.00	410,828.27
1871..	4 188,180.00	186,876.81	1,303.19	1911..	17,278,976.10	16,814,726.93	464,249.17
1872..	197,070.00	195,977.25	1,092.75	1912..	10 23,090,842.15	21,673,241.01	1,417,601.14
1873..	202,440.00	201,321.22	1,118.78	1913 11	24,735,135.80	24,044,657.08	690,478.72
1874..	257,690.00	233,765.78	23,924.22	1914 11	12 30,212,832.64	22,532,285.39	7,680,547.25
1875..	337,380.00	321,079.83	16,300.17	1915..	30,493,840.64	20,162,933.15	10,330,907.49
1876..	249,120.00	198,843.64	50,276.36	Total	242,438,080.74	126,004,413.70	14 26,239,428.40
1877..	194,686.96	188,206.19	6,480.77				
1878..	198,640.00	197,634.94	1,005.06				

<sup>1</sup> Includes \$1,646.45 of the appropriation for reclamation of arid lands, carried to the fiscal year 1882.

<sup>2</sup> Includes \$85.26 of the appropriation for reclamation of arid lands and \$3,530.85 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1883.

<sup>3</sup> Includes \$7,656.13 of the appropriation for reclamation of arid lands, carried to the fiscal year 1884.

<sup>4</sup> Including deficiency appropriation.

<sup>5</sup> Includes \$93,192.27 of the appropriation for Bureau of Animal Industry and \$2,970.82 of the appropriation for quarantine stations, carried to the fiscal year 1886.

<sup>6</sup> For the fiscal year 1888, including the sum of \$8,000 appropriated for deficiencies in the appropriation for experiments in the manufacture of sugar for the fiscal years 1887 and 1888, of which \$7,927.50 was disbursed and \$72.50 remained unexpended.

<sup>7</sup> Includes \$12,923.25 of the appropriation for botanical investigations and \$58,364.76 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1890.

<sup>8</sup> Includes \$188,974.69 of the appropriation for Bureau of Animal Industry, carried to the fiscal year 1891.

<sup>9</sup> Includes \$7,891.94 for statutory salaries of the year 1894.

<sup>10</sup> The figures under "Amount appropriated" for the fiscal years 1912, 1913, and 1914 represent the agricultural bill, permanent annual appropriations, deficiency acts, special acts, and also unexpended balances carried forward from previous years.

<sup>11</sup> For the years 1914 and 1915 the figures given represent payments made to close of June 30, 1915, the accounts for those years being still open at the date of this revision.

<sup>12</sup> This total is the amount actually appropriated for the various fiscal years, with the exception of \$37,604.70 appropriated July 13, 1868, to cover a number of expenditures made in previous years. It does not include an aggregate sum of \$369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)

<sup>13</sup> Does not include \$37,604.70 which was disbursed during several years and covered by an appropriation of like amount made July 13, 1868. (See note 12.)

<sup>14</sup> Does not include an aggregate sum of \$369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)





## REPORT OF THE EDITOR.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
DIVISION OF PUBLICATIONS,  
*Washington, D. C., September 30, 1915.*

SIR: I have the honor to submit herewith the report of the operations of the Division of Publications for the fiscal year ended June 30, 1915.

Respectfully,

JOS. A. ARNOLD,  
*Editor and Chief.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### SUMMARY.

During the year 913 new bulletins, pamphlets, circulars, reports, and documents of all kinds were issued, the printed copies aggregating 26,496,661. There were issued through the Division of Publications 822 new documents, and 91 were issued through the Weather Bureau.

The total output of documents of all kinds, new and reprints of earlier issues, aggregated 36,075,561 copies, of which 9,578,900 were reprints. The new miscellaneous publications contributed by the various bureaus, divisions, and offices numbered 836, of which 20,626,661 copies were printed. There were 77 new Farmers' Bulletins, of which there were printed 5,870,000 copies, while reprints were ordered of 243 Farmers' Bulletins, aggregating 8,925,000 copies. The total number of copies of Farmers' Bulletins of all kinds printed during the year was 14,795,000. Of the miscellaneous publications 653,900 copies were reprinted of 153 different pamphlets. The output of administrative manuals, orders, blank books, circulars, separates, etc., exclusive of publication work proper, aggregated over 53,000,000 copies.

### WORK OF THE YEAR.

The act of August 1, 1914, making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1915, and for other purposes, appropriated \$500,000 for the printing and binding for the United States Department of Agriculture. This amount is appropriated to the Public Printer, who is authorized to execute orders for printing and binding to the limit of the amount appropriated. The requisitions for printing and binding are, by authority of the Secretary of Agriculture, issued by this division, which has general supervision of the printing and binding and the administration of the fund, except for the Weather Bureau.

This office issued on the Public Printer 4,647 requisitions for printing and binding, compared with 5,200 during the preceding year. Of the requisitions issued in 1915 there remained at the close of business on June 30, 1915, 652 for which deliveries of completed work had not been made, compared with 478 on the same date for 1914.

Of the department's appropriation of \$500,000 for printing and binding, not exceeding \$137,500 was provided for Farmers' Bulletins and not exceeding \$47,000 for the Weather Bureau.

The appropriation for salaries of this division was \$170,750, and that for miscellaneous expenses \$18,750.

The actual expenditures under the supervision of this division were as follows:

Printing and binding.....	\$469,984.21
Salaries of employees (all on statutory roll).....	168,019.14
Miscellaneous expenditures for materials, supplies, etc.....	18,440.46

For purposes of comparison, the following statement of appropriations under the supervision of this division for the five fiscal years ended June 30, 1911, 1912, 1913, 1914, and 1915, is given:

Appropriations.	1911	1912	1913	1914	1915
Statutory roll of the division.....	\$172,730	\$179,960	\$194,700	\$166,410	\$170,750
General printing fund (excluding Weather Bureau)...	435,000	423,000	428,000	443,000	<sup>1</sup> 443,000
General expenses of the division.....	30,000	30,000	25,000	18,250	18,750
Total.....	637,730	632,960	647,700	627,660	632,500

<sup>1</sup> This year \$17,000 of the \$47,000 usually allotted to the Weather Bureau was used for general departmental printing and binding.

#### EXPENDITURES FOR PRINTING AND BINDING.

The total expenditures for printing and binding for the fiscal year ended June 30, 1915, were \$499,966.84, and the following tables show the amount of this sum used for each bureau, division, and office of the department, the amounts expended in publishing the various classes of publications, and the per cent of the whole used for each class:

*Total expenditures for printing and binding for the fiscal year ended June 30, 1915, by bureaus.*

Bureau or office.	Amount.	Bureau or office.	Amount.
Miscellaneous (Secretary).....	\$221,478.13	Division of Publications.....	\$9,235.54
Bureau of Plant Industry.....	44,847.53	Office of Markets.....	6,589.55
Bureau of Soils.....	38,351.42	Federal Horticultural Board.....	4,454.54
Bureau of Animal Industry.....	30,600.73	Bureau of Biological Survey.....	4,259.96
Weather Bureau.....	29,982.63	Office of Public Roads.....	3,792.22
Office of Experiment Stations.....	29,783.56	Division of Accounts and Disbursements.....	2,207.81
Forest Service.....	21,709.85	Insecticide and Fungicide Board.....	993.78
Bureau of Crop Estimates.....	16,440.01		
Bureau of Chemistry.....	13,088.15		
Bureau of Entomology.....	11,558.12	Total.....	499,966.84
Library.....	10,593.31		

*Statement showing expenditures for all kinds of work and the percentage of the same to the total expenditures.*

Class of work.	Amount.	Per cent.	Class of work.	Amount.	Per cent.
Farmers' Bulletins.....	\$137,495.61	27.50	Index cards.....	\$16,585.25	3.32
Publications and department bulletins.....	63,619.77	12.72	Blank books.....	14,829.73	2.96
Periodical publications.....	61,233.06	12.27	Letterheads.....	11,647.10	2.32
Blank forms.....	55,392.66	11.10	Posters, placards, labels, maps, etc.....	9,340.16	1.86
Congressional.....	51,545.49	10.31	Compilation of laws, manuals, fiscal regulations, etc.....	5,876.37	1.17
Miscellaneous administrative circulars, orders, decisions, etc.....	28,715.35	5.74	Envelopes.....	217.29	.04
Separates and unnumbered pamphlets.....	23,030.83	4.60	Memoranda sheets.....	109.65	.02
Binding.....	20,328.52	4.07	Total.....	499,966.84	100.00

## CLASSIFIED EXPENDITURES.

In the following tabulated statements there are combined the total expenditures of the department by bureaus, divisions, and offices, classified according to the kind and character of the work secured, with the number of copies of each class of work produced.

While the Division of Publications does not have supervision of the appropriation for the Weather Bureau, a statement of expenditures of that bureau, being necessary to show the entire expense for the department for printing, is included, making the total output by the department approximate 89,000,000 pieces at an expense of \$499,966.84.

In addition to this there was a specific appropriation of \$7,000 for the printing of Report 100 of the Secretary's Office on Potash from Kelp, from which amount 3,000 copies of the report, which also are not included in the above statement, were secured.

*Expenditures for job work and binding and for regular publications, miscellaneous documents, circulars, and reports (arranged by bureaus, divisions, and offices), during the fiscal year ended June 30, 1915.*

Bureau.	Job work and binding.	Regular publications, miscellaneous documents, circulars, and reports.	Total.
Miscellaneous (Secretary).....	\$18,019.08	\$65,963.44	\$83,982.52
Bureau of Plant Industry.....	21,931.31	22,916.22	44,847.53
Bureau of Soils.....	714.46	37,636.96	38,351.42
Bureau of Animal Industry.....	19,600.10	11,000.63	30,600.73
Weather Bureau.....	13,253.40	16,729.23	29,982.63
Office of Experiment Stations.....	4,116.20	25,667.36	29,783.56
Forest Service.....	11,453.26	10,256.59	21,709.85
Bureau of Crop Estimates.....	9,142.84	7,297.17	16,440.01
Bureau of Chemistry.....	4,619.31	8,468.84	13,088.15
Bureau of Entomology.....	2,355.52	9,202.60	11,558.12
Library.....	10,555.68	37.63	10,593.31
Division of Publications.....	1,845.03	7,390.61	9,235.54
Office of Markets.....	2,073.90	4,515.65	6,589.55
Federal Horticultural Board.....	3,438.75	1,015.79	4,454.54
Bureau of Biological Survey.....	490.12	3,769.84	4,259.96
Office of Public Roads.....	1,312.71	2,479.51	3,792.22
Division of Accounts and Disbursements.....	2,197.97	9.84	2,207.81
Insecticide and Fungicide Board.....	330.72	663.06	993.78
Total.....	127,450.36	235,020.87	362,471.23
Farmers' Bulletins.....			137,495.61



*Expenditures for printing and binding (arranged by bureaus, divisions, and offices) for the fiscal year ended June 30, 1915.*

Bureau, division, or office.	Total.		Farmers' bulletins.		Publications and department bulletins.		Periodical publications.		Blank forms.		Congressional.		Miscellaneous administrative circulars, orders, decisions, notices, etc.		Separates and unnumbered pamphlets.	
	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.
Miscellaneous (Secretary).	20,651,951	\$221,478.13	15,049,000	\$137,495.61	465,000	\$4,338.04	6,166,000	\$34,840.36	2,762,225	\$9,480.49	37,446	\$13,293.84	159,250	\$3,098.23	4,271,550	\$7,746.93
Bureau of Plant Industry.	10,217,133	44,847.53			758,500	16,365.96			2,959,700	6,645.60	2,500	86.47	362,300	1,410.99	427,500	5,052.80
Bureau of Soils.	399,183	38,351.42			43,000	3,196.49			146,100	349.22	50,300	34,071.34	1,000	197.08	6,000	172.05
Bureau of Animal Industry.	14,559,082	30,600.73			170,000	3,084.05			9,379,900	10,265.66	2,500	143.70	973,350	6,552.51	95,700	1,220.37
Weather Bureau.	5,606,895	29,982.63			5,500	4,719.15			5,448,860	7,708.01	1,002	3,381.21	12,850	575.00	31,925	1,268.15
Office of Experiment Stations.	1,360,916	29,783.56			163,000	9,587.54			194,250	487.55	1,500	35.20	14,100	1,437.35	14,700	400.14
Forest Service.	3,743,898	21,709.85			94,000	3,878.43			2,192,480	5,085.77	2,500	129.08	69,550	2,593.74	47,600	691.74
Bureau of Crop Estimates.	4,853,951	16,440.01			11,000	462.17			3,098,940	6,476.05	2,500	42.09	321,000	4,863.17	10,000	213.46
Bureau of Chemistry.	2,423,479	13,088.15			54,500	2,564.04			788,750	1,470.97	1,000	25.96	550,200	5,668.37	11,000	168.00
Bureau of Entomology.	2,769,407	11,558.12			193,750	8,511.57					7,500	52.66			46,200	551.38
Library.	292,679	10,993.51							185,000	108.53	500	37.63				
Division of Publications.	8,420,290	9,235.54							1,027,825	779.04	1,000	88.30			3,800,000	3,705.63
Office of Markets.	1,610,729	6,589.55							302,000	1,046.53	7,500	81.48	104,000	580.20	85,500	1,663.47
Federal Horticultural Board.	2,154,862	4,454.54							1,753,500	2,493.76	2,500	44.33	126,300	942.21	5,000	29.25
Bureau of Biological Survey.	513,728	4,259.96			72,500	2,484.69			163,954	393.34	2,500	36.92	17,200	143.48	2,650	104.75
Office of Public Roads.	341,965	3,792.22			31,800	2,391.40			102,172	417.03	2,500	35.40			5,000	52.71
Division of Accounts and Disbursements.	347,671	2,207.81							206,045	1,642.64	100	9.84				
Insecticide and Fungicide Board.	231,100	993.78							87,000	202.91	1,500	10.04	85,000	653.02		
Total.	88,898,859	499,966.84	15,049,000	137,495.61	2,195,550	63,619.77	9,027,060	61,233.06	30,946,296	55,392.66	126,848	51,545.49	2,796,100	28,715.35	8,860,325	23,030.83

Bureau, division, or office.	Binding.		Index cards.		Blank books.		Letterheads.		Posters, placards, labels, maps, etc.		Compilation of laws, manuals, fiscal regulations, etc.		Envelopes.		Memoranda sheets.	
	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.	Copies.	Cost.
Miscellaneous (Secretary).	11,631	\$1,863.51	86,000	\$532.55	44,600	\$3,177.31	364,920	\$521.13	177,329	\$2,332.88	3,000	\$2,706.04	52,500	\$55.81	1,500	\$50.40
Bureau of Plant Industry.	658	642.52	2,324,069	\$3,344.37	389,076	5,663.86	2,517,500	4,271.94	412,234	1,266.69			63,096	96.33		
Bureau of Soils.	3,083	17.63	29,500	93.98	200	131.76	120,000	121.87								
Bureau of Animal Industry.	2,574	300.08	2,085,950	2,847.06	10,008	1,542.51	1,488,000	2,109.24	351,100	2,534.95						
Weather Bureau.	3,142	3,976.36	82,500	173.55	766	942.42			8,700	453.06						
Office of Experiment Stations.	788	1,457.31	354,330	1,377.14	248	66.92	456,200	707.80	4,800	15.72						
Forest Service.	8,387	1,388.74	488,900	1,723.72	18,481	1,782.35	755,000	970.70	46,000	488.45	11,000	2,963.60			1,000	3.76
Bureau of Crop Estimates.	41,002	35.30	405,500	1,548.29			696,000	1,076.23	9	6.88						3.76
Bureau of Chemistry.	751	1,367.12	197,900	459.30	728	604.51	768,000	628.30	48,150	86.81	2,000	42.47			500	2.30
Bureau of Entomology.	2,741	170.79	358,000	586.11	2,220	335.07	127,500	240.54	1,857,501	670.95			25,000	12.50		10,000
Library.	6,593	8,294.25	59,036	2,103.83			5,000	10.48	1,550	4.77			10,000	6.90	25,000	26.92
Division of Publications.	583	299.82	978,000	497.06	882	72.83	190,000	178.08	30	18.20						
Office of Markets.	725	258.26	22,000	136.11	1,904	132.08	292,500	359.04	40,600	101.32	12,000	164.26			7,000	33.82
Federal Horticultural Board.	12	13.24	68,550	165.06			38,000	69.08	161,000	697.61					2,000	12.74
Bureau of Biological Survey.	343	227.00	50,600	139.94	1	13.34	110,000	177.18	93,980	539.32						
Office of Public Roads.	1	1.20	108,150	489.09	450	138.75	87,000	149.98	1,832	113.21			3,000	3.45		
Division of Accounts and Disbursements.					20	207.64	10,000	17.29							1,000	3.45
Insecticide and Fungicide Board.	206	9.79	130,300	317.16											5,000	5.03
			25,500	56.93	100	18.38	25,000	38.13	2,000	9.34						
Total.	83,220	20,328.52	7,852,785	16,585.25	469,654	14,829.73	8,050,620	11,647.10	3,206,815	9,340.16	28,000	5,876.37	166,596	217.29	40,000	109.65

NOTES.—The Division of Publications does not have supervision of the appropriation for the Weather Bureau. A statement of the expenditures for that bureau, however, is included in order to show the total expenditures for printing and binding for the department.

In addition to the regular appropriation for the department there was a specific appropriation of \$7,000 for the printing of Report No. 100, Office of the Secretary, entitled "Potash from Kelp," which amount was entirely expended for 3,000 copies which are not included in above statement.

Total appropriation for the department.....	\$500,000.00	Appropriation for department, exclusive of Farmers' Bulletins.....	\$302,500.00	Appropriation for Farmers' Bulletins.....	\$137,500.00
Total expenditures.....	499,966.84			Expenditures for Farmers' Bulletins.....	137,495.61

Balance.....	33.16	Balance.....	4.39
Total expenditures.....	439,900.04	Expenditures exclusive of Farmers' Bulletins.....	362,471.23
		Farmers' Bureaus.....	\$904,900.00
		Expenditures for Farmers' Bulletins.....	19,486.00

Balance.....	33.16	Balance.....	28.77
		Balance.....	4.39

## FIXED CHARGES AGAINST THE PRINTING FUND.

There are certain fixed charges against the printing fund which amount to approximately \$125,000, and this sum must be deducted from the amount of the appropriation before the amount available for miscellaneous reports of investigations, etc., can be ascertained.

The following statement shows in detail the expenditures for publications, documents, and other work, which are regularly printed, and may be considered as constituting fixed charges against the appropriation for printing and binding:

*Expenditures for publications, documents, and other work, regularly printed, constituting fixed charges against the appropriation.*

Publication.	Cost for year.	Publication.	Cost for year.
Experiment Station Record.....	\$14,207.13	Expenditures, Office of Experiment Stations.....	\$783.64
Journal of Agricultural Research and separates.....	14,734.00	Annual Report of the Secretary.....	345.66
Weekly News Letter.....	22,501.24	Annual Report, Department of Agriculture.....	569.23
Department circular.....	1,062.53	Total.....	109,305.52
Monthly List of Publications.....	3,596.58	Service and Regulatory Announcements.....	8,042.16
Monthly Crop Report.....	1,716.28	Annual Reports.....	933.97
Yearbook (including separates).....	12,679.53	Statistical blanks.....	6,476.05
Field Program.....	425.93	Organization List.....	439.60
Directory of Bureau of Animal Industry.....	1,296.91	Grand total.....	125,197.30
Monthly Letter (Entomology).....	86.99		
States Relations Service Monthly.....	49.78		
Program of Work.....	1,211.38		
Full report and soil surveys.....	34,038.66		

An analysis of the above table shows that the largest fixed charge is for the Field Operations of the Bureau of Soils and Soil Surveys and amounts to more than \$34,000. The Weekly News Letter follows, consuming \$22,500; the Journal of Agricultural Research and the separates therefrom, \$14,734. The Experiment Station Record costs \$14,200 and the Yearbook, including separates, \$12,679.

The additional charges over \$1,000 are: \$8,042 for the Service and Regulatory Announcements of the different bureaus; \$3,596 for the Monthly List of Publications; \$1,716 for the Monthly Crop Report; \$1,296 for the Directory of the Bureau of Animal Industry; \$1,211 for the Program of Work of the Department; and \$1,062 for the Department Circular. The blanks required monthly by the Bureau of Crop Estimates for the statistical report of its field agents, State, county, and crop correspondents, consumed last year \$6,476 of the department's appropriation for binding and printing.

## STATISTICS OF PUBLICATION WORK.

The following statement shows the contributions to the departmental series of bulletins and the Farmers' Bulletin series by the various bureaus, divisions, and offices:



*New bulletins contributed by the various bureaus, divisions, and offices during the year and authorized to be printed, but not all issued during the year.*

Bureau.	New bulletins.	Number of copies.	Farmers' Bulletins.	Number of copies.
Bureau of Animal Industry.....	9	68,000	10	665,000
Bureau of Biological Survey.....	7	30,000	4	280,000
Bureau of Chemistry.....	4	21,000	.....	.....
Bureau of Entomology.....	40	140,000	19	680,000
Office of Experiment Stations.....	20	133,500	4	250,000
Forest Service.....	13	127,000	1	45,000
Bureau of Plant Industry.....	42	371,000	29	1,270,000
Office of Public Roads.....	7	49,000	.....	.....
Bureau of Soils.....	12	38,000	.....	.....
Bureau of Crop Estimates.....	2	11,000	9	1,935,000
Office of Markets.....	10	155,000	2	100,000
Total.....	166	1,143,500	78	5,225,000

The following statement shows the total number of copies of all publications of the department issued during the last 26 years:

*Publications of all kinds issued by the department, 1890-1915.*

Year.	Number issued.	Year.	Number issued.	Year.	Number issued.	Year.	Number issued.
1890.....	1,904,300	1897.....	6,541,210	1904.....	12,421,386	1911.....	27,594,877
1891.....	2,833,933	1898.....	6,280,365	1905.....	12,475,157	1912.....	34,678,557
1892.....	2,348,797	1899.....	7,075,975	1906.....	13,488,527	1913.....	33,356,366
1893.....	3,446,181	1900.....	7,152,428	1907.....	16,746,910	1914.....	38,186,392
1894.....	3,169,310	1901.....	7,889,281	1908.....	16,875,516	1915.....	36,075,561
1895.....	4,100,660	1902.....	10,586,580	1909.....	17,190,345		
1896.....	6,561,700	1903.....	11,698,564	1910.....	25,190,465	Total...	365,869,343

#### COMMITTEE ON EXAMINATION OF MANUSCRIPTS.

The committee on manuscripts met regularly twice a week during the year, considered 798 new manuscripts, and made recommendations concerning them to the Secretary. Where the matters concerned were of sufficient importance, conferences were held with the representatives from the bureaus, divisions, and offices, with the result that better understanding of the subject matter of the bulletins was reached and more satisfactory publication results were secured.

#### FARMERS' BULLETINS.

The Farmers' Bulletins continue to increase in popular favor. Since the series was established, 674 bulletins have been issued, of which 77 new ones were issued during the year—the largest number for any similar period. Of earlier Farmers' Bulletins 243 were reprinted, of which 8,925,000 copies were issued, while 5,870,000 copies were printed of the new Farmers' Bulletins, making a total of 14,795,000 copies of Farmers' Bulletins printed during the year.

The plans made last year have been followed, and the bulletins show an increasing improvement in brevity, clearness of statement, and adaptation to restricted locality.

The following table gives the output of Farmers' Bulletins during the last nine years, and the expenditure therefor:

*Output of Farmers' Bulletins and the cost for the fiscal years 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, and 1915.*

Fiscal year.	Fund drawn upon.	Number issued.	Number of copies.	Cost.
1907.....	Farmers' Bulletin fund.....	235	6,469,000	\$98,601.17
1908.....	do.....	252	6,574,500	98,601.49
1909.....	do.....	271	7,755,000	122,475.48
1910.....	do.....	299	9,337,500	126,579.37
1911.....	do.....	295	9,219,000	118,012.06
1912.....	do.....	344	10,409,000	122,753.33
1913.....	do.....	327	9,680,850	109,472.11
1914.....	do.....	339	14,960,000	136,854.75
1915.....	do.....	320	14,795,000	137,495.61

The appropriation for Farmers' Bulletins for the year was not more than \$137,500 of the \$500,000 appropriated to the department for printing and binding, the same as for the preceding year; therefore the same quota of 12,500 was allotted to each Senator, Representative, Delegate, and Resident Commissioner in Congress as for the previous year.

With the above appropriation 14,795,000 copies of Farmers' Bulletins were provided, of which 7,402,000 were distributed upon the orders of Senators, Representatives, Delegates, and Commissioners.

The following table shows the output of Farmers' Bulletins during the 26 years since the series was instituted, with the congressional distribution for each year:

*Output of Farmers' Bulletins during 26 years, with Congressional distribution.*

Year.	New bulletins issued.	Total number of copies printed.	Copies distributed by Congressmen.	Year.	New bulletins issued.	Total number of copies printed.	Copies distributed by Congressmen.
1890-1893.....	14	540,000	.....	1906.....	33	6,568,000	5,279,476
1894.....	5	278,500	.....	1907.....	42	6,469,000	3,484,713
1895.....	11	1,567,000	883,770	1908.....	26	6,574,500	3,928,437
1896.....	13	1,891,000	1,316,685	1909.....	34	7,755,000	3,960,642
1897.....	16	2,387,000	1,967,237	1910.....	45	9,337,500	6,449,589
1898.....	21	2,170,000	1,580,065	1911.....	48	9,219,000	5,474,079
1899.....	22	2,437,000	1,101,985	1912.....	44	10,409,000	7,351,262
1900.....	18	2,360,000	1,666,909	1913.....	42	9,680,850	5,803,088
1901.....	14	3,345,000	2,195,010	1914.....	55	14,960,000	8,399,579
1902.....	23	6,150,000	4,289,126	1915.....	77	14,795,000	7,402,072
1903.....	22	6,602,000	3,954,976				
1904.....	25	6,435,000	4,895,556	Total.....	674	137,855,850	86,170,089
1905.....	24	5,925,500	4,782,643				

#### WORK OF WEATHER BUREAU.

The printing division of the Weather Bureau has charge of the printing, binding, and distribution of all Weather Bureau publications, and it furnishes and ships all blank forms, map-bases, charts, letterheads, etc., used by the bureau at Washington and at its numerous stations. It supervises the selection and purchase of all printing presses and printing materials needed at Weather Bureau stations.

The Weather Bureau series of bulletins having been discontinued, such professional papers as can not be incorporated in the regular

issues of the Monthly Weather Review are now published in a series of supplements to the Review, of which two were issued during the year, viz:

Supplement No. 1. Types of Storms of the United States and their Average Movements; with 114 charts showing the average 24-hour movement of each type for each month of the year.

Supplement No. 2, already prepared, will contain (a) a calendar of the common trees of the Eastern United States, and (b) a record of the time of leafing, blooming, and fruiting of numerous native and cultivated plants growing in the vicinity of Wauseon, Ohio.

Volume XII, Daily River Stages of the Principal Rivers of the United States, for 1913 and 1914, is now in course of delivery.

Owing to the cessation of foreign weather reports at the beginning of the European war, the issue of a daily weather map of the Northern Hemisphere had to be discontinued August 6, 1914.

The total daily, weekly, and monthly issue and disposition of periodical publications at the close of the fiscal year was as follows:

*Total daily, weekly, and monthly issue and disposition of periodical publications at Washington, D. C.*

	Domestic addresses.	Foreign addresses.	Total.
Weather Map, first edition, daily .....	1,015	.....	1,015
Weather Map, second edition, daily .....	328	87	415
Monthly Weather Review .....	1,006	370	1,375
National Weather and Crop Bulletin (weekly, April to September; monthly, October to March) .....	3,298	27	3,325
Snow and Ice Bulletin (weekly during winter) .....	1,310	10	1,320
Climatological Data, monthly .....	369	75	444
Monthly Meteorological Summary .....	225	.....	225
Forecast Cards, daily .....	1,550	.....	1,550
Forecast Cards, weekly .....	225	.....	225

The above-mentioned publications were issued at Washington. Many thousands of weather maps, weather bulletins, river bulletins, cotton-region bulletins, and daily forecast cards were issued at the Weather Bureau stations throughout the United States.

#### NEW FEATURES OF THE WORK.

The publication of the Farmers' Bulletin, entitled The Agricultural Outlook, was discontinued with the issue of April, 1915. Beginning with May, 1915, and monthly thereafter, statistics relating to agricultural conditions, including estimates of acreage, production, yields, prices of live stock, and text summaries were published in a serial of the Bureau of Crop Estimates, known as the Monthly Crop Report. This publication is a resumption in size and nature of material of the Crop Reporter, which was discontinued with the issue of June 19, 1913.

Under Memorandum No. 118, issued January 14, 1915, provision is made for office circulars and that any such circulars, whether printed or mimeographed, shall differ in make-up from the regular publications either in size or color of paper or ink. They must be numbered in inconspicuous type, and at least two copies forwarded to the document clerk of the main library at the time the circular is issued. Several such circulars, ephemeral in character, and designed for immediate



use, were printed during the year. Memorandum No. 118 also provides for the publication of titles of kindred publications on pages of bulletins which otherwise would be blank. Such lists are prepared by the submitting bureau and revised by this division, and have appeared in publications whenever it was economical to insert them.

With regard to reprints of publications, particularly Farmers' Bulletins, the policy was inaugurated of inserting the date of the reprint, the object being to make clear to the public that though the bulletin was issued some time ago, it is still considered suitable for distribution by the department.

Some progress was made during the year toward securing uniformity in the paper used for letterheads.

The character and form of the Yearbook of the Department is maintained practically as that of 1914, with the exception of an increased number of articles, a fuller appendix, and additional pages.

But few bulletins of the various series of the bureaus, divisions, and offices were reprinted, dependence being placed on the Superintendent of Documents exercising the authority vested in him by law to reprint in case the demand proved sufficient to justify it, it being the department's policy to expend the appropriation for new bulletins.

The experience of the previous year showing that the classification of the department's publications then in vogue did not afford a place for occasional bulletins and reports such as were formerly included in the bureau series of publications, the restriction was removed by reviving the series of numbered reports of the Secretary's office, seven of which were issued and several more were in process of printing at the close of the fiscal year.

The policy inaugurated February 1, 1914, of issuing a monthly series of service and regulatory announcements for each bureau or board charged with the enforcement of regulatory acts was continued throughout the year. The miscellaneous administrative circulars, orders, decisions, etc., were reduced this year to 194 from 548 of the preceding year, although the pages increased from 2,133 in 1914 to 3,127 during 1915.

#### SALES OF DEPARTMENT PUBLICATIONS.

Notwithstanding a wide free distribution of publications by the department, the sales by the Superintendent of Documents aggregated 321,518 copies, for which that official received \$23,011.10, and distributed 14,345 additional copies to subscribers. Sales of the department's publications for the last six years are shown in the accompanying table:

*Sales of agricultural publications by the Superintendent of Documents during the fiscal years 1910-1915.*

Years.	Number of copies.	Amount received.	Years.	Number of copies.	Amount received.
1910.....	147,327	\$18,398.18	1913.....	183,139	\$17,885.40
1911.....	183,577	18,657.17	1914.....	231,821	21,708.76
1912.....	171,866	16,428.07	1915.....	335,863	23,011.10

The Superintendent of Documents sold 1,000 copies or more of each of 25 different publications of the department; 4,000 copies or more each of 10 publications; over 10,000 copies of each of five documents; and of Farmers' Bulletin No. 361, "The Use of Concrete on the Farm," and No. 481, "Concrete Construction on the Live Stock Farm," he sold, respectively, 12,976 and 13,658, or nearly one-half as many as the department distributed gratuitously of those two farmers' bulletins.

It is evident that there is an increased willingness on the part of the public to purchase our publications when they can no longer be secured upon application to the department. If some more convenient means could be adopted for the purchase of our publications, the sales could be very greatly increased.

The number of copies of our publications sold during the year exceeded by 104,042 those sold last year, and the amount received was \$1,302.34 more than that for the preceding year. Under the provisions of the law of January 12, 1895, the Superintendent of Documents is authorized to reprint and sell any publications, the proceeds derived from the sales to cover the cost of printing. It is possible, therefore, to secure any Government publication from that official when the same can not be obtained from the department issuing it. In compliance with requests for such publications that official reprinted during the year 645 different documents issued by the Department of Agriculture, the number of copies aggregating 239,025. This exceeds the number of copies reprinted during the preceding year by 47,750 copies.

All remittances for publications should be forwarded by the applicant to the Superintendent of Documents, Government Printing Office, but although instructions are plainly printed at the head of the Monthly List of Publications, advising applicants to apply to that official when they desire to purchase publications after the department's supply is exhausted, remittances continue to come to this office, the amount received during the year being \$2,295.60. A careful record of the money so received and daily forwarded to the Superintendent of Documents was maintained in this office.

#### WORK OF THE DIVISION BY BRANCHES.

The administrative office of the division, under the direction of the editor and chief, and including the office of the chief clerk, comprises, in addition to those officials, 20 stenographers, typewriters, bookkeepers, clerks, messengers, charwomen, and laborers. The details of the four branches of the work were under the immediate supervision of the assistant in charge, as follows:

(1) Editing, B. D. Stallings, editor and assistant chief, the force comprising 8 assistant editors, 2 clerks, and a messenger; (2) indexing, Chas H. Greathouse, the force comprising 8 indexers, clerks, and messenger; (3) illustrations, A. B. Boettcher, the force comprising 24 draftsmen, photographers, colorists, clerks, laborers, and messenger; (4) distribution of documents, F. J. P. Cleary, the force comprising 106 stenographers and typewriters, clerks, folders, foreman, forewoman, skilled laborers, classified laborers, and messengers.

## EDITING.

The changes in classification and form of the publications instituted in 1914 have increased the amount of work required of this office although the number of new publications is apparently less than for the previous year.

The following table shows the number of new publications and reprints issued during the last 10 years (1906–1915, inclusive):

*Number of publications issued.*

Class.	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915
New publications...	414	521	447	650	1,085	<sup>1</sup> 1,170	<sup>1</sup> 1,250	<sup>1</sup> 1,771	<sup>1</sup> 1,152	<sup>1</sup> 913
Reprints.....	654	819	998	485	462	696	648	429	474	393
Total.....	1,068	1,340	1,445	1,135	1,547	1,866	1,898	2,200	1,626	1,306

<sup>1</sup> Not including press notices, which were mimeographed.

Manuscripts comprising 84,609 folios, as compared with 63,943 folios for the previous year, with 4,925 illustrations, compared with 3,493 illustrations for the year 1914, were read and edited during the year. The proof reading and revising comprised 6,861 galleys, as compared with 5,616 galleys of the previous year, and 31,243 pages, in contrast to 23,456 for the year 1914.

It will be seen from the following table that the new numbered bulletins were 183—46 more than last year—and that by adding the other documents, which are properly classed as publications, the aggregate new published documents is 913. This is 230 less than the number reported last year, the decrease being the result of including a number of notices of judgment, etc., in the service and regulatory announcements; but the number of pages is 27,916 and illustrations 3,572 as compared with 21,638 and 3,140 for the years 1915 and 1914, respectively.

In addition to the figures contained in the table, there were 666 press notices issued from the Office of Information and Forest Service during the year, of which 33 originated in the Forest Service. The 633 prepared in the Office of Information were mimeographed in the Division of Publications, comprising 674 legal cap sheets and aggregated 1,078,820 copies.



*Classification of the publications of the United States Department of Agriculture printed during the fiscal year ended June 30, 1915.*

Character of published documents.	New.			Earlier issues reprinted.			Total.		
	Number.	Pages.	Illustrations.	Copies.	Number.	Pages.	Illustrations.	Pages.	Copies.
Miscellaneous administrative circulars, orders, decisions, notices, B. A. I. orders, directory, regulations, service and regulatory announcements, field programs, notices of judgment, food-inspection decisions, instructions to workers, circular letters, lists of workers, financial reports, notices of quarantine, etc.	194	3,127	22	1,578,650	78	268	.....	3,385	1,718,650
Separates and unnumbered pamphlets (Year-book separates, separates from Journal of Agricultural Research, lists of Farmers' Bulletins and other publications, and inventories)....	166	2,278	442	7,808,630	17	249	25	2,527	7,985,730
Bulletins (numbered bulletins and circulars of the bureau series and department series)....	183	5,785	1,348	1,210,000	55	1,562	283	7,347	1,538,800
Serial publications (Weekly News Letter, Journal of Agricultural Research, Experiment Station Record, Monthly List of Publications, Monthly Bulletins of Weather Bureau, Congressional Yearbooks, Field Operations of the Bureau of Soils, Soil Surveys, Annual Reports, and Congressional Documents).....	193	6,831	734	9,097,569	.....	.....	.....	6,831	9,097,569
Compilation of laws, manuals, fiscal regulations, Farmers' Bulletins.....	89	7,030	399	792,462	.....	.....	.....	7,030	792,462
	11	1,379	6	139,350	.....	.....	.....	1,379	139,350
	77	1,486	621	5,870,000	243	6,972	2,389	8,458	14,785,000
Total.....	913	27,916	3,572	26,496,661	393	9,051	2,697	36,967	36,075,561

## INDEXING.

The work of the index section was somewhat enlarged during the fiscal year. The preparation of lists of the department publications on lines closely related to the subjects of books and manuscripts about to go to the printer has been performed in that office. Some compilation work has been performed and a study of a classification for the farmer of the department books has been begun.

The calls for references on farm topics made up from the indexes have grown steadily in number, especially during the last half of the year, showing an increase in the usefulness of the system as it becomes better known. There are three or four times as many calls for such references as were received a few years ago. The value of the work of this office to the department would be largely increased if everyone in the department who can use the indexes had in mind the fact that such assistance could be promptly rendered.

The daily reading and marking of the Congressional Record consumed a considerable portion of every morning while Congress was in session and occupied a large portion of the working time of this office. In connection with the reading of the Record, the supplying of public documents (bills, laws, etc.) to the different branches of the department has demanded more attention as different bureaus have from experience discovered that the work is performed here.

The index kept in connection with the Congressional Record has demonstrated its usefulness by supplying references in a few moments that would have required hours of search if there had been no index.

The preparation of index cards for current publications as they appear has continued to be the main business of the indexers, and during the year nearly 30,000 pages have been indexed, exclusive of the indexing of the Congressional Record, of which publication 13,127 pages were indexed. Copies of these cards have been made as heretofore, in some cases five sets being required and in others only one. The total number of index cards written during the year was 61,559. The indexing of the department publications, such as yearbooks, annual reports, etc., has gone on as usual and has occupied a considerable portion of the time of the indexers. Also a number of indexes for volumes of Farmers' Bulletins were made, an index for the complete set of Crop Reporters has consumed much time and is now almost complete, and a complete index of the first 500 Farmers' Bulletins now awaits publication.

A classification of the books of the department was undertaken by the direction of the Assistant Secretary and considerable work has been done upon it. It is expected that this classification, combined with a classification of the publications of other departments of the Government, will soon be completed, arranged so that books in the same general field will be found grouped together, and assembled with regard to practical farming, so that the ordinary reader can find readily what he wants.

## ILLUSTRATIONS.

During the year 2,520 drawings were prepared by the draftsmen, as compared with 2,061 drawings in the preceding year, the bulk of the work being accomplished by four draftsmen. The increase of work is not fully shown in the nearly 500 additional drawings, as many required an exceptional amount of time and care in their preparation.

*Summary of drawings prepared during the fiscal year 1915.*

Office of the Secretary.....	408
Bureau of Plant Industry.....	759
Bureau of Animal Industry.....	218
Forest Service.....	36
Bureau of Chemistry.....	200
Bureau of Biological Survey.....	94
Bureau of Crop Estimates.....	145
Bureau of Soils.....	2
Bureau of Entomology.....	166
Office of Experiment Stations.....	192
Division of Publications.....	250
Office of Public Roads.....	4
Office of Markets.....	46
Total.....	2,520

The commodious and easily accessible quarters into which the Section of Illustrations recently moved have greatly contributed to the increased efficiency and output of work.

In the photographic laboratory a total of 138,832 pieces were prepared, as compared with 112,272 pieces during the preceding year. Over 2,000 negatives were made in the field for various offices and the results obtained in technically correct photographs fully justified the expenditure.

*Summary of photographic work done during the fiscal year 1915.*

Contact prints.....	73,946
Negatives.....	9,766
Films and plates developed.....	6,704
Blue prints.....	12,563
Bromide enlargements.....	6,403
Maps and prints mounted.....	8,092
Solar bromide prints.....	3,513
Lantern slides.....	15,812
Lantern slides colored.....	1,544
Transparencies.....	321
Transparencies colored.....	168
Total.....	138,832

One hundred and seventy-eight requests for photographic work were received from persons outside of the department, for which \$710.29 was collected and turned over to the disbursing office.

A number of requests were also received for duplicates of cuts of illustrations appearing in department publications. These duplicates were furnished by electrotypers at the applicants' expense.



*Photographic work done for the different bureaus, divisions, and offices of the department, and for the public during the fiscal year 1915.*

Bureau, division, or office.	Contact prints.	Negatives.	Films and plates developed.	Blue prints.	Bromide enlargements.	Maps and prints mounted.	Solar bromide prints.	Lantern slides.	Lantern slides colored.	Transparencies.	Transparencies colored.	Total.
Office of the Secretary.....	2,102	267	60	183	865	988	111	163	47	318	165	5,269
Weather Bureau.....	12	1	48									60
Bureau of Plant Industry.....	43,386	2,161	4,522	2,326	163	319	1,075	4,436	794	3	3	59,188
Bureau of Animal Industry.....	9,698	1,242	386	4,469	304	385	233	4,085	395			21,197
Forest Service.....	115	16										131
Bureau of Chemistry.....	3,295	441	36	68	37	28	16	689				4,610
Bureau of Biological Survey.....		1			4							5
Bureau of Crop Estimates.....	149	5		490		3	454					1,101
Bureau of Soils.....							12					49
Bureau of Entomology.....	2,328	73	32	436	7	256	120	93				3,345
Office of Experiment Stations.....	7,081	376	760	4,466	64	1,430	1,389	4,551	244			20,361
Division of Publications.....	1,512	104		2	15	4,618	103	11	13			6,378
Office of Public Roads.....				58		1						59
Office of Markets.....	3,101	5,065	860	28	4,872	7		273	35			14,241
Library.....	28	11										42
Paid orders.....	1,139	1			72	57		1,511	16			2,796
Total.....	73,946	9,766	6,704	12,563	6,403	8,092	3,513	15,812	1,544	321	168	138,832

During the fiscal year just closed the Motion Picture Laboratory, under the direction of the motion-picture committee, produced a total of 45,900 feet of negative film and 82,900 feet of positive film. It also developed 15,350 feet of negative film made elsewhere.

Of the above film, 8,200 feet of negative and 56,200 feet of positive were used in cooperation with the Government Exhibit Board of the Panama-Pacific International Exposition in producing and assembling subjects for other departments, the expense being defrayed by the board or the department interested.

Twenty-three films were completed for the various bureaus and offices of the department, comprising the following subjects:

- Congressional Seed Distribution.
- Uncle Sam's Pig Club Work.
- Constructing a Concrete Silo.
- The Work of a Forest Ranger.
- Lumbering Lodgepole Pine.
- The Grazing Industry of the National Forests.
- Lodgepole Pine for Railroad Ties.
- Tree Planting in the National Forests.
- National Forests as Recreation Grounds.
- "Bull Run," Portland's Water Supply.
- Lumbering Yellow Pine in the Southwest.
- What a Careless Hunter in the Woods Can Do.
- Testing Rock to Determine its Value for Road Building.
- Rock Tests with Traction Dynamometer.
- Road Construction and Maintenance.
- Concrete Road Construction (Ohio Post Road).
- Macadam Road Construction (Maryland Post Road).
- Gravel Road Construction (Virginia Post Road).
- Bituminous Macadam Road Construction (Maine Post Road).
- Cement and Concrete Tests.
- The Strawberry Industry of Warren County, Kentucky.
- The American Sardine Industry of Maine.
- Corn from Field to Can.

These films were shown at country schoolhouses, churches, and county fairs by the department's representatives, and were used ex-

tensively in connection with field and demonstration meetings. The great majority of the films were also shown in connection with the Government exhibit at the Panama-Pacific International Exposition.

#### DISTRIBUTION OF DOCUMENTS.

On July 1, 1914, there were 5,817,510 publications on hand. Adding to this number the 33,529,527 received from the Public Printer, there was an aggregate of 39,347,037 available for distribution. Of this number 32,202,087 were distributed, leaving on hand July 1, 1915, a balance of 7,144,950. In addition to the documents mentioned above, 4,000,000 lists of Farmers' Bulletins were distributed, the greater portion of which were sent out on requisitions from Members of Congress. Thus the total distribution for the year ended June 30, 1915, amounted to 36,202,087, which is 301,577 more than distributed during the previous fiscal year. Of the total distribution 14,528,807 were Farmers' Bulletins, 7,402,072 of which were sent out upon requisitions of Senators, Representatives, Delegates, and Resident Commissioners in Congress, and 7,126,735 in response to requests received from miscellaneous applicants. Therefore, 200,000 more Farmers' Bulletins were distributed during the fiscal year under discussion than during the preceding year.

Of the publications other than Farmers' Bulletins distributed through the document section, the aggregate was 17,673,280, an increase of 2,773,550 over the previous year, or an increase of practically 17 per cent.

During the fiscal year upwards of 50,000 letters were received from Members of Congress requesting the forwarding of Farmers' Bulletins to their constituents. The compliance with these requests necessitated the issuing of 42,000 orders on the Superintendent of Documents. In addition to requisitions for Farmers' Bulletins, Members submitted requests for 37,721 miscellaneous publications. Requests for documents of the department were received direct from 626,000 applicants, other than those received from Members of Congress, necessitating the issuing of 581,587 orders on the Superintendent of Documents and the forwarding of 626,000 cards acknowledging the receipt of the requests and quoting prices at which the Superintendent of Documents would furnish the publications when the department's supply had been exhausted.

A card record was kept of 28,000 copies of the Yearbook that were distributed, by means of which duplication was avoided; and 65,000 addresses were written for the use of other offices of the department.

A very important part of the work is the replying to requests for information by typewritten letters where the department has no printed matter on the subject. The press bulletin matter issued through the Office of Information reaches a widely distributed public and frequently contains information that has not appeared in bulletin form. Interested persons seeing these notices write and request a publication covering the subject, making a specific letter necessary. Many thousand requests for information on subjects not properly coming within the scope of the Department are also received.

Notwithstanding the fact that the Superintendent of Documents handles the larger part of the publications distributed by the depart-

ment, 9,953,206 documents were distributed directly from the folding room in this section. In the preparation of these publications for mailing over 5,025,000 were received in such condition that they required folding before mailing, which work was also accomplished here, and 3,300 copies of various publications, including the Year-book and Field Operations of the Bureau of Soils, were wrapped, while nearly one million addressed envelopes furnished by other offices and bureaus were filled and sealed, and 13,950 placards or posters were incased in tubes, the completed work being mailed to addresses furnished by the issuing offices.

*Summary of the work done in the folding room.*

(A) Sent out:

Monthly Lists.....	120,000
Weekly News Letter.....	1,930,300
Outlook.....	200,000
Crop Reports.....	24,000
Press Notices.....	1,174,290
Farmers' Bulletin Lists (general).....	3,300,000
Farmers' Bulletin Lists (city).....	700,000
Publications as per scheme.....	1,980,888
Publications to transients and sundry requests.....	41,328
Monthly List of Station Publications.....	14,400
Crop Synopsis.....	24,000
Flexotype Forms of Instructions (N. NR. CO. CR. R. N., etc.)...	444,000
Total.....	9,953,206

(B) Folded:

Press Notices.....	1,174,290
Form Letters No. 58.....	187,500
Miscellaneous (department circulars, etc.).....	150,000
Flexotype Forms of Instructions (O. NR. CR. CO. R. N., etc.)...	444,000
Crop Synopsis.....	24,000
Monthly List of Station Publications.....	14,400
Total.....	1,994,190

(C) Separated:

Farmers' Bulletin List (general).....	3,300,000
Total.....	3,300,000

(D) Wrapped:

Yearbooks Department of Agriculture.....	1,000
Field operations Bureau of Soils—	
Maps.....	600
Text.....	600
Annual Reports Department of Agriculture.....	100
Miscellaneous (returned bound volumes of publications).....	1,000
Total.....	3,300

(E) Filled and sealed:

Envelopes furnished by miscellaneous offices.....	950,000
Total.....	950,000

(F) Filled:

Tubes for egg placards.....	12,000
Tubes for egg candling charts.....	250
Tubes for poisonous plant charts.....	500
Tubes for maps for report 100.....	1,200
Total.....	13,950



This department maintains, in the Superintendent of Document's office in the Government Printing Office, 421 individual mailing lists containing 523,435 addresses. All additions, removals, and other changes made at the Government Printing Office are ordered from the mailing list record room, and the amount of detail required in connection therewith is very great. Another important feature of the work of this room is the revision of the mailing lists controlled by this division, to which are sent the Monthly List, Weekly News Letter, Crop Report, and Press Notices, etc. More than 200,000 addresses on these lists were revised last year.

*Statement of work on addressing lists.*

Addresses written for different divisions.....	363, 922
Miscellaneous addresses written.....	160, 498
Work prepared for Government Printing Office.....	137, 124
Carding on typewriter for general index.....	200, 000
Mailing.....	201, 185
Folding.....	913, 911
Addresses revised.....	202, 771
Indexing.....	400, 000
Addresses compared.....	200, 000

**LABOR-SAVING MACHINES.**

One of the most important subdivisions of the document section is the machine room, wherein the labor-saving machines are installed and operated. Here the work of stencil cutting, addressing of envelopes, folding, and duplicating work is done. The work done in this branch of the office is of great magnitude. Last year 95,343 new stencils were cut, while 40,014 stencils were removed from the files, an increase of 100 per cent in cutting and 50 per cent in removals over similar work done last year; 5,256,281 envelopes and franks were addressed, an increase of over 2,000,000 above the number addressed during the previous year. More than 700,000 congressional franks, received in this office in sheets, were cut. In addition to this, 1,100,000 sheets of paper were cut for the various bureaus, offices, and divisions of the department. A total of 2,242,418 circulars were folded on the folding machines. In all, there are 180,798 stencils containing addresses in this office. These addresses go to make up the department mailing lists of the various bureaus.

The flexotype and mimeograph work has become a most important feature of its activities. Requests were received from the various offices of the Department for 2,226 jobs of this character during the year ended June 30, 1915, under which 3,530,832 copies were made, containing 5,218,727 pages.

A statement showing in detail the work done in the machine room is given below:

*Summary of flexotype and mimeograph work.*

Bureau.	Number of jobs.		Number of pages.	Number of copies.
	Flexo-type.	Mimeo-graph.		
Secretary's office.....	89	.....	256,765	173,265
Chief clerk's office.....	29	.....	47,600	47,600
Solicitor's office.....	71	.....	95,205	90,475
Experiment stations.....	14	4	25,600	875
Office of Information.....	17	.....	80,600	17,750
Plant Industry.....	650	682	69,345	13,495
Division of Publications.....	95	.....	1,847,390	1,174,290
Road Inquiry.....	6	.....	1,453,082	942,252
Federal Horticultural Board.....	60	.....	570,700	569,450
Chemistry.....	365	.....	41,250	21,125
Library.....	1	.....	146,760	56,960
Biological Survey.....	41	.....	422,405	288,895
Bureau of Soils.....	1	.....	300	300
Appointment clerk's office.....	2	.....	23,550	19,800
Bureau of Entomology.....	44	.....	800	800
Insecticide and Fungicide Board.....	41	.....	1,000	1,000
Bureau of Crop Estimates.....	5	.....	65,350	43,575
Animal Industry.....	3	.....	28,500	26,500
Division of Accounts.....	4	.....	2,575	2,575
Rural Organization Service.....	2	.....	23,000	23,000
Total.....	1,540	686	2,250	2,250
			14,700	14,600
			5,218,727	3,530,832

*Summary of miscellaneous machine work.*

Stencil addresses cut.....	95,343
Stencil addresses removed.....	40,014
Envelopes and franks addressed.....	5,256,281
Congressional franks cut.....	717,191
Sheets of paper cut for various bureaus.....	1,119,019
Pads made for various bureaus.....	33,584
Circulars etc., folded.....	2,242,418

*Number of stencils belonging to various bureaus.*

Office of Information.....	21,262
Bureau of Crop Estimates.....	70,839
Bureau of Chemistry.....	700
Bureau of Biological Survey.....	303
Bureau of Entomology.....	240
Office of Experiment Stations.....	3,844
Forest Service.....	5,377
Insecticide and Fungicide.....	3,416
Library.....	1,392
Federal Horticultural Board.....	3,527
Bureau of Plant Industry.....	62,875
Division of Publications.....	6,425
Public Roads.....	363
Bureau of Soils.....	231
Solicitor's office.....	4
Total number of stencils.....	180,798

## FOREIGN MAIL.

Requests for sending publications to foreign countries are attended to in this office. During the fiscal year just ended 44,049 packages of publications were forwarded to foreign addresses. The aggregate weight of same was 22,560.5 pounds, requiring \$1,646.75 for postage. There was a decrease of 14,497 in the number of packages over the number sent last year, but the weight increased 760 pounds. The increase in weight caused an increase in postage of \$73 over the amount expended during the previous year.

A statement showing in detail the record of the foreign mail is given below:

*Summary of the foreign mail for the year ended June 30 1915.*

Divisions.	Packages requiring postage.			Packages sent through the Smithsonian.			Total.		
	Number.	Weight.	Postage.	Number.	Weight.	Value.	Number.	Weight.	Value.
		<i>Lbs. Ozs.</i>			<i>Lbs.</i>			<i>Lbs. Ozs.</i>	
Animal Industry.....	1,459	445 4	\$35.62	1,110	704	\$35.20	2,569	1,149 4	\$70.82
Biological Survey.....	56	16 10	1.33	262	134	6.70	318	150 10	8.03
Chemistry.....	1,751	481 14	38.55	569	328	16.40	2,320	809 14	54.95
Crop Estimates.....	2,862	508 8	40.68	1,538	746	37.50	4,400	1,254 8	78.18
Entomology.....	2,547	805 10	64.45	1,959	942	47.10	4,506	1,747 10	111.55
Office of Experiment Stations...	7,954	6,880 4	550.42	324	169	8.45	8,278	7,049 4	558.87
Forest Service.....	88	25 8	2.14	207	115	5.65	295	140 8	5.69
Journal of Agricultural Research.	2,745	2,711 14	216.95	1	1	.15	2,746	2,712 14	217.00
Library.....	9,711	3,880 12	310.46	3,003	1,554	77.70	12,714	5,434 12	388.16
Markets.....	238	36 12	2.94	76	31	1.55	314	67 12	4.49
Plant Industry.....	1,512	865 2	69.21	367	194	9.70	1,879	1,059 2	78.91
Publications.....	4	1 10	.13	13	7	.35	17	8 10	.48
Roads.....	17	5 8	.44	180	92	4.60	197	97 8	5.04
Secretary.....	2,040	307 2	24.57	721	283	14.15	2,761	590 2	38.72
Soils.....	325	168 4	13.46	410	210	10.50	735	378 4	23.96
Total.....	33,309	17,140 10	1,371.25	10,740	5,510	275.50	44,049	22,650 10	1,646.75
Total for fiscal year 1914.....	45,352	15,978 2	1,278.25	13,194	5,910	295.50	58,546	21,888 2	1,573.75
Total for fiscal year 1915.....	33,309	17,140 10	1,371.25	10,740	5,510	275.50	44,049	22,650 10	1,646.75
Gain during the fiscal year 1915.....	(1)	1,162 8	93.00	(2)	(2)	(2)	(3)	762 8	73.00

Items.	Packages.	Weight.	Postage.
Packages to which postage was affixed.....	33,309	<i>Pounds.</i> 17,140.5	\$1,371.25
Packages sent through the International Exchange, Smithsonian Institution (at \$0.05 per pound).....	10,740	5,510.0	275.50
Grand total.....	44,049	22,650.5	1,646.75

<sup>1</sup> Decrease of 12,043 packages requiring postage.

<sup>2</sup> Decrease of 254 packages weighing 400 pounds.

<sup>3</sup> Decrease in total number of packages, 14,495.

The Smithsonian Institution is reimbursed from the department's contingent fund at the rate of 5 cents per pound.





## REPORT OF THE CHIEF OF THE BUREAU OF CROP ESTIMATES.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF CROP ESTIMATES,  
*Washington, D. C., October 1, 1915.*

SIR: I have the honor to submit herewith the report of the Bureau of Crop Estimates for the fiscal year ended June 30, 1915.

Respectfully,

LEON M. ESTABROOK,  
*Chief of Bureau.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### INTRODUCTION.

The title "Bureau of Crop Estimates" was assumed on July 1, 1914, in lieu of the former title "Bureau of Statistics," as provided in the act making appropriations for the fiscal year ended June 30, 1915. Various changes in the organization of the bureau were effected as outlined in the Annual Report of the Bureau for the fiscal year ended June 30, 1914.

In lieu of the former system of having a special field agent for a group of two or more States, whose territory was too large to be covered effectively, and a State statistical agent in each State, who was not selected because of special fitness for the work and who devoted only a portion of his time thereto, a trained field agent has been assigned to each State, except the following:

The field agent for Massachusetts reports also for Vermont, New Hampshire, and Maine; the field agent for New York reports also for Connecticut and Rhode Island; the field agent for Pennsylvania reports also for New Jersey; the field agent for Maryland reports for Delaware; the field agent for Utah reports for Nevada, and the field agent for New Mexico reports also for Arizona. The total number of field agents is therefore 39, each of whom has a corps of volunteer State aids who report to him monthly, the number in each State varying from 250 in some of the smaller States to more than 1,000 in the larger States. With few exceptions the field agents are legal residents of the States to which they are assigned and are men of mature judgment, practical experience in farming, and trained in methods of estimating crop and live-stock production. They are required to travel throughout their States several weeks each month during the crop season and to collect crop and live-stock data from every available source.

In addition to the field agents the bureau has a cotton-crop specialist, a rice-crop specialist, and a tobacco specialist who travel throughout the regions where these special crops are grown and each of whom maintains a list of selected volunteer crop reporters. During the fiscal year just closed a statistical scientist, who was formerly in charge of the Division of Crop Reports, was designated as truck-crop specialist, with a view to organizing special lists of volunteer truck-crop reporters and making estimates of the acreage, condition, and yield of the principal truck crops.

### PERSONNEL.

At the close of the fiscal year the total number of salaried employees was 151, of whom 109 were stationed in Washington and 42 in the field. The total number of volunteer crop reporters and special correspondents throughout the United States was approximately as follows:

#### *Number of voluntary crop reporters and special correspondents.*

County.....	2, 805	Bean.....	923
Township.....	30, 100	Broom corn.....	440
Field.....	15, 822	Cranberry.....	142
Special price.....	5, 978	Potato.....	4, 629
Individual farm.....	28, 193	Apple.....	1, 758
County cotton.....	787	Tobacco.....	830
Township cotton.....	7, 916	Honeybee.....	5, 050
Individual farm cotton.....	7, 594	Sheep.....	6, 225
Special cotton.....	5, 249	Rice.....	145
Mills and elevators.....	6, 693	Truck crop.....	8, 000
Live stock.....	4, 514		
Hop.....	850	Total.....	147, 327
Peanut.....	3, 311		

### EXPENDITURES.

The total appropriation for the Bureau of Crop Estimates for the fiscal year 1915 was \$275,580, of which \$115,580 was for statutory salaries in Washington and \$160,000 lump sum. The lump sum appropriation was expended approximately as follows:

Salaries.....	\$88, 135
Travel, station, and field expenses.....	51, 623
Office and field supplies and equipment.....	14, 683
Freight, express, and drayage.....	405
Telegraph and telephone service.....	1, 080

The unexpended balance of about \$4,000, which will be returned to the Treasury, was due to a saving in salary and travel expenses in a few of the States where field agents were not appointed until near the close of the fiscal year because of delay in establishing eligible registers from which appointments could be made.

### ROUTINE WORK.

During the fiscal year 17,400 letters were received, 14,800 letters were written, and in the same period approximately 751,470 copies of circular letters of inquiry, schedules, and preliminary crop estimates were printed on duplicating machines and mailed. Over 2,000 requisitions of various kinds were drafted, 241 bills of lading



were issued, 108 letters of authorization were written, 2,433 transportation requests were issued, and 1,770 vouchers in settlement of accounts were given administrative examination. The bureau also issued to its volunteer crop reporters 18,000 special forms for recording crop data, 14,500 Yearbooks, 42,700 calendars, and 403,000 packages of seed.

Owing to a reassignment of storage space it was necessary to move and rearrange approximately 40 tons of stationery, documents, and equipment. Approximately 1,275,000 schedule inquiries were folded and mailed to the field force during the year, and the returns were tabulated, computed, and summarized by the Division of Crop Reports. A vast amount of information regarding crop and livestock production in this and other countries was compiled in the Division of Crop Records for the Yearbook, for other branches of the department, for publication, or for use in answering special inquiries.

### PUBLICATIONS.

In addition to the material prepared in the bureau for publication in the "Agricultural Outlook," "The Monthly Crop Report," and the statistical appendix of the Yearbook, manuscript articles were prepared for publication, as follows:

Department Bulletin No. 74, Inland Boat Service: Freight Rates on Farm Products and Time of Transit on Inland Waterways in the United States.

Department Bulletin No. 177, The Production and Consumption of Dairy Products.

Field Agents Hand Book of Agricultural Statistics.

Movement from City and Town to Farm; reprint of an article in the Department Yearbook for 1914.

Revision of Circular No. 17, Government Crop Reports: Their Value, Scope, and Preparation.

Foreign Trade of the United States in Farm and Forest Products.

The Agricultural Element of the Population in Various Countries.

### THE MONTHLY CROP REPORT.

The publication of the Farmers' Bulletin entitled "The Agricultural Outlook" was discontinued with the issue of April, 1915. Beginning with May, 1915, the publication entitled "Monthly Crop Report" was begun as a serial of the Bureau of Crop Estimates. It was also provided that, inasmuch as the Monthly Crop Report will set forth results obtained in the Bureau of Crop Estimates, the value of which depends largely upon their prompt and timely publication, the transmission of the manuscripts through the Division of Publications to the Public Printer will be expedited, and the Chief of the Bureau of Crop Estimates will be held responsible to the Secretary for all matters contained therein. The Monthly Crop Report is a resumption, in size and nature of material, of the Crop Reporter, which was discontinued with the issue of June, 1913. The publication of statistical matter was resumed, however, on September 11, 1913, in the Agricultural Outlook. In addition to the statistical data the Outlook included a number of chapters or articles dealing with timely matters of production. It was found impossible, however, to publish the Outlook quickly enough to make the crop figures fully serviceable to the public. Moreover, the cost was found to be greater than was expected, comparatively few Members of Congress ordered it for their

constituents, and the special articles published therein frequently were lost sight of and failed to secure the direct attention of farmers that the circular series or the Weekly News Letter would give them. The separation of the Crop Report from other material not directly pertaining thereto will enable the department to publish the details of the crop report more promptly, effect certain economies, and make possible a more direct circulation of both classes of material.

### SPECIAL INQUIRIES AND INVESTIGATIONS.

Among the special inquiries and investigations which the Bureau of Crop Estimates carried on during the fiscal year 1915, in addition to its regular crop reports, are the following:

For the committee appointed by the Secretary to study the economics of the meat situation, statistical material from various domestic and foreign reports covering the number of meat animals, production, distribution, and consumption of meat and meat products, and production of feeding stuffs in all the principal meat producing and consuming countries of the world.

Compilation of special data relating to production, supply, consumption, exports, imports, and prices of farm products for the Secretary and the Assistant Secretary of Agriculture.

Percentage of apple shipments in carload lots; Agricultural Outlook for August, 1914 (Farmers' Bulletin 615), p. 14.

Durum wheat exports; Agricultural Outlook for August, 1914 (Farmers' Bulletin 615), p. 15.

Supply of cattle hides; Agricultural Outlook for August, 1914 (Farmers' Bulletin 615), p. 17.

Honey production; Agricultural Outlook for September, 1914 (Farmers' Bulletin 620), p. 6.

Wheat crop of 1913-14, wheat supplies and requirements, and "world" wheat crop in 1914; Agricultural Outlook for October, 1914 (Farmers' Bulletin 629), pp. 4-7.

Disposition of feed crops; Agricultural Outlook for October, 1914 (Farmers' Bulletin 629), p. 7.

Hop consumption; Agricultural Outlook for November, 1914 (Farmers' Bulletin 641), p. 6.

The world's wheat; Agricultural Outlook for November, 1914 (Farmers' Bulletin 641), p. 7.

Cost of producing cotton; Agricultural Outlook for November, 1914 (Farmers' Bulletin 641), p. 12.

Relative production of apple varieties; Agricultural Outlook for November, 1914 (Farmers' Bulletin 641), p. 16.

Food production and requirements of various countries; Agricultural Outlook for November, 1914 (Farmers' Bulletin 641), p. 20.

Onion and cabbage estimates; Agricultural Outlook for December, 1914 (Farmers' Bulletin 645), p. 11.

Purchasing power of farmers; Agricultural Outlook for December, 1914 (Farmers' Bulletin 645), p. 18.

Stocks of potatoes, January 1, 1915; Agricultural Outlook for February, 1915 (Farmers' Bulletin 651), p. 5.

Fall seedings in the cotton States, showing increase in the acreage of fall-sown wheat and fall-sown oats; Agricultural Outlook for February, 1915 (Farmers' Bulletin 651), p. 7.

Production of upland long-staple cotton; Agricultural Outlook for February, 1915 (Farmers' Bulletin 651), p. 12.

Spring wheat production, by varieties; Agricultural Outlook for March, 1915 (Farmers' Bulletin 665), p. 4.

Stocks of wool in manufacturers' hands; Agricultural Outlook for March, 1915 (Farmers' Bulletin 665), p. 7.

Time of transit to England through Panama Canal; Agricultural Outlook for March, 1915 (Farmers' Bulletin 665), p. 7.

The sugar supply; Agricultural Outlook for April, 1915 (Farmers' Bulletin 672), p. 5.

The world wheat acreage in 1915; Agricultural Outlook for April, 1915 (Farmers' Bulletin 672), p. 7.

Average sowings per acre in Europe and America; Agricultural Outlook for April, 1915 (Farmers' Bulletin 672), p. 9.

Wagon hauls for farm products; Agricultural Outlook for April, 1915 (Farmers' Bulletin 672), p. 11.

Acreage in early potatoes on the Atlantic seaboard, from the eastern shore of Virginia to Florida; Monthly Crop Report for May, 1915.

Production and uses of straw; Monthly Crop Report for May, 1915.

Percentage of acreage planted in 10 principal truck crops, April 15, 1915, in 6 early truck-producing States; Monthly Crop Report for May, 1915, p. 5.

Chart showing monthly exports of wheat (including flour) from the United States; Monthly Crop Report for May, 1915, p. 7.

Cotton, oats, and corn planting periods, chart; Monthly Crop Report for June, 1915, pp. 5 and 7.

Wheat harvest periods, chart; Monthly Crop Report for June, 1915, p. 5.

Apples carried on railroads and boat lines in the United States, June 1 to November 30, 1914; Monthly Crop Report for June, 1915, p. 4.

### TRUCK-CROP ESTIMATES.

At the beginning of the fiscal year a statistical scientist of the bureau was designated as truck-crop specialist and assigned to the investigation of truck-crop areas and production. He has visited the principal trucking sections, personally investigated trucking conditions, and secured the names of approximately 8,000 farmers, growers, dealers, canners, and associations interested in the growing, handling, and marketing of truck crops, who have agreed to serve as volunteer truck-crop reporters of the bureau. As a result of the investigations of the truck-crop specialist and reports from correspondents, a report showing the estimated acreage, yield, and production of onions and cabbages in the northern belt of States was published in November, 1914; a report showing the acreage of onions in southern Texas for 1914 and 1915 was issued in February, 1915; an estimate of the early potatoes in Florida, South Carolina, North Carolina, and Virginia was issued on April 30, 1915; an estimate of the acreage of watermelons and cantaloupes for 1914 and 1915 in North Carolina, South Carolina, Georgia, Florida, Alabama, Texas, and California was issued in May, 1915; an estimate of the percentage of acreage planted in principal truck crops to April 15, 1915, in six States of early production, was issued in April, 1915, and an estimate of the acreage in corn, peas, and tomatoes under contract to canners in the years 1913, 1914, and 1915 was issued in July, 1915.

The truck crops for which acreage estimates were undertaken by the truck-crop specialist during the fiscal year were watermelons, cantaloupes, cabbages, onions, early potatoes, tomatoes, and strawberries. As the work on truck crops becomes better organized it is planned to include other crops than those mentioned.

### INTERNATIONAL INSTITUTE OF AGRICULTURE.

Monthly reports were made to the International Institute of Agriculture at Rome, Italy, showing acreage, condition, and yield of crops, and numbers of live stock in the United States; and for cereals and cotton, exports and imports. Cable reports from the Institute were received, summarized as news items, and forwarded to the Office of Information for issuance to the press.



**IMPROVEMENTS IN ORGANIZATION FOR ESTIMATING CROP AND LIVE-STOCK PRODUCTION.**

Methods of improving the crop-reporting service are constantly under consideration in the Bureau of Crop Estimates. As pointed out in the annual report of this Bureau for the fiscal year ended June 30, 1914, the most difficult problem encountered in crop reporting is an attempt to estimate acreages planted to different crops and the numbers of different classes of live stock on farms; also such special crops as truck and fruit. To take an annual census of acreages and live stock can not be considered because of the enormous expense involved and the time required to compile and publish the results. Returns of local tax assessors in the various States are not always complete, uniform, or available when needed. In lieu of an annual census enumeration the best substitute appears to be an organization or system of reporting for definite areas under the constant observation of field agents who are trained in crop-reporting methods, supplemented by reports of large numbers of individual farmers distributed throughout each area, and by reports of trained specialists on each crop. This in effect is the system at present employed by the Bureau of Crop Estimates. Obviously, the smaller the territory assigned to each field agent, or, what means the same thing, the greater the number of field agents assigned to a given territory, the more thoroughly the acreages and condition of crops and the numbers of different classes of live stock can be studied and the more satisfactory will be the results. That better results can be secured from a smaller division of territory has been fully demonstrated during the fiscal year 1915, when for the first time the Bureau had a trained field agent in each of the principal agricultural States, instead of one agent for a group of States, as formerly. However, it is evident that even a single State in the important producing areas is entirely too large for one man to cover effectively.

If sufficient funds were available fully to develop and perfect the crop-reporting service, it would be highly desirable to give each field agent one or more trained assistants, so that the territory he covers could be divided into districts and a survey made of its agricultural resources and production by counties. It would also be desirable to provide each field agent with a clerk to assist in folding and mailing schedules of inquiry, opening and tabulating returns, and handling correspondence and other necessary office work, so as to relieve the field agents of the burden of routine details and leave them free to devote their entire time to the more important and difficult work of studying, analyzing, estimating, and forecasting crop conditions and prospects.

To provide such an organization, grouping the smaller States and dividing the larger ones, would cost approximately \$475,000, which, with \$50,000 for the administrative office at Washington, would make a total of \$525,000 per annum.

Greater efficiency would result if some of the field agents were provided with automobiles. Crop estimates can not be made entirely from written reports of correspondents, nor can the field agent judge of the condition and probable yield of a crop from the fleeting glimpse he gets through a car window when speeding across the country between cities and towns. During the growing season, especially at critical

periods in the life history of a crop, field agents must get out in the field and examine individual plants. The greater the number of fields examined, the more accurate will be the field agent's judgment of the extent of damage from various causes. At the present time field agents travel from town to town by rail or trolley, and at each point it is usually necessary to hire a conveyance to go out into the country. Trains run at irregular intervals, and it is often difficult to obtain a conveyance at stopping points. The agent can inspect only a small territory in the vicinity of a town and often loses much time waiting for trains. The use of automobiles by agents would obviate many of these difficulties and by enabling the field agents to visit crop-producing areas not readily accessible by railway, with power to stop at any point en route to examine particular fields, would increase the efficiency and dependability of the service many fold.

It is highly desirable also that the clerical force in Washington should be increased in order to handle properly the increased number of returns from the field force and to meet the increasing demands which are constantly being made upon the bureau for special investigations. Irrespective of whether the field force is increased, the desirability of a substantial increase in the clerical force of the bureau is becoming more and more apparent. There has been an increase of only 11.5 per cent (10 clerks) in the clerical force of the bureau during the past decade, while the volume of work to be done has nearly doubled and is likely to increase as the agriculture of the country develops and as interest grows in the production and consumption of agricultural products.

An appropriation of \$650,000 per annum (including statutory salaries) would enable the bureau greatly to improve the crop-reporting service. This amount is approximately 10 cents per annum for each farm in the United States and less than 0.01 per cent of the estimated annual value of crops and live stock raised each year on these farms. While this total seems large, it is for estimating the acreage and production of all the principal crops (more than 50 in number) and the several classes of live stock in the United States, and it is less than double the amount annually appropriated by Congress for taking a census of a single crop—i. e., a report by the Bureau of the Census of the amount of cotton ginned. While improvement in the crop-reporting service as suggested is greatly to be desired, on account of the existing situation it is not intended to submit any recommendation this year that Congress appropriate the additional funds necessary to make such improvement practicable.

The fact that the crop-reporting service has been able to meet the increasing demands upon it with its present inadequate force is due largely to the cooperation of public-spirited men in every community who serve as voluntary crop reporters without monetary compensation and to the loyal and efficient service of employees in the field and in the Washington office who cheerfully work outside of the customary office hours and on Sundays and legal holidays when necessary to tabulate returns in order to get the crop reports out promptly.





## REPORT OF THE LIBRARIAN.

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U. S. DEPARTMENT OF AGRICULTURE,  
OFFICE OF THE LIBRARIAN,  
*Washington, D. C., September 30, 1915.*

SIR: I have the honor to submit herewith the executive report of the library for the fiscal year ended June 30, 1915.

Respectfully,

CLARIBEL R. BARNETT,  
*Librarian.*

Hon. DAVID F. HOUSTON,  
*Secretary of Agriculture.*

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In the record of the activities of the library during the past year the event which stands out most prominently is the change in its location from the ground floor of Laboratory A to the new eight-story office building which was erected for the department at 1358 B Street SW. A change was necessary on account of the crowded condition of the library and also because of the need of expansion of the offices and laboratories located in Laboratory A. The moving of the library, including the transportation of the furniture and shelving as well as the books, was begun on January 25 and completed on February 20. It is estimated that approximately 85,000 books, about two-thirds of the library's collections, are shelved in the main library and were therefore transferred to the new building. The library occupies the whole of the first floor and part of the basement; in all, 12,207 square feet. In many respects the present quarters of the library are a considerable improvement over those of former years. The reading and reference rooms are larger and more comfortable, as are also the workrooms for the staff, and the books in the stacks are more convenient for use. While the present quarters seemed the best possible solution of the library's difficulties under existing conditions, they should be considered only as a temporary makeshift, to be remedied at the earliest possible date. The value of the library and its great importance in the work of the department most urgently demand that there be provided for it, as soon as possible, permanent, suitable, and adequate quarters owned by the Government, which quarters, as regards location and construction, shall be subject to a minimum risk of fire. The destruction of the library would be an irreparable loss to the department. It is regretted that conditions in the past have seldom made it possible, when planning the location of offices, to give consideration to their use of library facilities. This necessitates greater delay in filling requests, more duplication of

material, and more service. In the plans for the future work and development of the department it is hoped that the needs of the library, and also its convenient use, can receive careful consideration.

A large number of books was discarded during the past year, as it was deemed advisable to hasten this work in order to dispose of any books which were not needed prior to the moving and thus avoid transporting them to the new building. The work of discarding was done under the general direction of the library committee especially appointed to consider this matter. In the work of discarding, the library had the help not only of the library committee but also of members of the scientific force of the Bureau of Crop Estimates and the Bureau of Soils. The number of books discarded was 5,910. As all but a small proportion of these were classified and catalogued, a large amount of work was involved in changing the library records and in the attempt to place the discarded books where they would be of service. In connection with the discarding it was necessary to consider the whole question of the scope and policy of the library. A detailed statement explaining the general policy as to the acquisition of material, the method of purchase, and the administration was accordingly prepared by the librarian for submission to the library committee. This statement is too extended to include in this report, but it is available in typewritten form.

The number of books and pamphlets added to the library last year, namely, 9,114, was slightly less than the number added during the previous year. This was due to the fact that it was necessary to spend a much larger amount during the past year for furniture and library equipment, the cost of the new library stacks being \$2,130. The total number of books and pamphlets now contained in the library, deducting the books recently discarded, is, in round numbers, 131,000. A selected list of the accessions to the library has been included in the new monthly departmental circular which has been issued since May, 1915, and will be continued in future numbers.

An unusually large number of periodicals was added to the library during the past year. This increase is due partly to the need of additional periodicals by the various bureaus of the department incident to new projects and the constantly broadening fields of investigation and partly to the additional publications which are being received in exchange for the *Journal of Agricultural Research* and other publications of the department. The total number of different periodicals now being received currently by the library is 2,337. Of these, 819 are received by purchase and 1,518 by gift. Attention is called to the table given in this report showing the distribution of the current periodicals by class. In addition to the current periodicals the library received over five thousand serials of less frequent edition, such as annuals, annual reports, proceedings, and transactions published by institutions and societies. About 8 per cent of these were received by purchase and 92 per cent by gift.

There was considerable delay during the year in obtaining some of the foreign periodicals published in the countries which are now at war. It has been the practice of the library for many years to order foreign periodicals through a New York dealer, from whom they are sent to us in packages by express. In previous years the library has sometimes received complaints about the delay in the receipt of certain periodicals, as copies subscribed for by scientists personally

directly from the publishers are received a few days before they are received by the library. The delay during the past year, due to the war, brought up this question more acutely. Correspondence with university and reference libraries which receive a large number of foreign periodicals has shown that none of those to whom the inquiry was sent deemed it advisable to have periodicals sent directly from the publishers by mail. They have reported that periodicals received directly by mail very often reach the library in folded or rolled form, which injures them for binding and circulation. When periodicals are ordered from a dealer and sent through the dealer, he can be held responsible for complete files, but he can not be held responsible if the periodicals do not pass through his hands. If periodicals are ordered from and sent directly from the publishers, it involves a large amount of correspondence and an increased number of small bills, with a consequent need of more assistants. This method of ordering, therefore, is much more expensive. In the case of the Government the difficulty in handling small accounts with foreign publishers is greater than it is for a private institution, owing to the complicated fiscal regulations. The additional expense, therefore, connected with having foreign periodicals sent directly from the publishers makes this method of ordering of doubtful advisability for a library ordering a large number of periodicals. The disadvantages, at least from the library point of view, more than outweigh the advantage of receiving the periodicals a few days earlier by mail. However, the matter is still under consideration. It may be decided to have sent by mail next year a few periodicals of special importance to test the practicability of the plan.

During the past year the collection of horticultural trade catalogues was arranged. These catalogues were formerly kept in several offices of the Bureau of Plant Industry. Through the cooperation of the Office of Economic and Systematic Botany of the Bureau of Plant Industry the catalogues are now being shelf-listed and indexed. The collection has been materially increased in the past few years by gifts and exchanges, and now comprises approximately 20,000 catalogues, being the largest collection in this country. It is arranged chronologically and alphabetically by dealer under the chronological arrangement. Contributions to the collection will be welcomed, since the aim is to make it as nearly complete as possible.

In connection with the statistics of the use of the library, shown on pages 6-8, an increase worthy of special note is that in the use of the books by the scientists connected with the State agricultural colleges and experiment stations. The number of books lent to the State agricultural colleges and experiment stations and other institutions outside of Washington during the past year was 1,196, an increase of 300 over the previous year, or approximately 33 per cent. To the number should also be added 101 photostat copies and 12 typewritten copies of articles from periodicals, which copies were sent in place of sending the books.

Several changes in organization and location of offices in the department have occurred during the past year and these changes have been reflected in the bureau, division, and office libraries. At the time the library was moved to its new location the Bureau of Biological Survey was also moved to the same building. On account of its proximity to the main library, it seemed advisable to reduce



very considerably its collections. Accordingly, about 1,500 volumes were returned to the library, including several long sets of periodicals. The collections in the libraries of the Bureau of Chemistry and the Bureau of Plant Industry were also reduced during the past year by returning to the main library books and pamphlets which had been called for only infrequently in these bureaus. On account of the tendency toward unity in scientific work, it is increasingly difficult to separate the books needed by one bureau from those needed by another. To attempt, therefore, to have bureau libraries adequately covering the literature of the various subjects investigated by the bureaus would in the case of some of them involve the maintenance of large separate collections nearly coextensive in scope with the main library. For these reasons the general policy in regard to the bureau, division, and office libraries is to make them strictly reference collections on the subjects of special interest to their respective bureaus and offices.

On July 1, 1914, the Rural Organization Service having been combined with the Office of Markets to form the Office of Markets and Rural Organization, the collections of both were placed under the jurisdiction of the librarian of the new office, who was formerly librarian of the Office of Markets. With the beginning of the calendar year, when the Office of Markets and Rural Organization was moved into its new quarters at 1358 B Street SW., the two collections were combined.

On May 1, 1915, the Office of Public Roads was moved into an up-town office building, some blocks from the department, necessitating the removal of its library. A few months previous the library of the office was very considerably reduced in size by returning about 3,000 books and pamphlets to the main library. These were principally Government, State, and city official publications. The library of the above office is now more of a special reference library of material in frequent demand in the work connected with roads and rural engineering.

The appropriation bill for the fiscal year 1916, which became effective July 1, 1915, provided for the transfer or combination of a number of offices of the department, and these changes made corresponding changes in the library work of the various offices concerned. Collections of books formerly filed in certain of the offices were changed to other offices and current periodicals formerly circulated in certain of the offices were dropped from their lists and sent instead to other offices. These changes in organization in the department require readjustment in library matters and are strong proof of the desirability of the centralized administration of the library work of the department. This centralization gives greater elasticity and prevents much waste of work and duplication by making it possible to shift material in the library from one office to another to meet the changed conditions.

In reporting on the activities of the bureau, division, and office libraries mention should be made of the very considerable amount of work other than library work which has been done by several of the libraries. This embraces principally secretarial work, editorial work, proof reading, the care of mailing lists, indexing correspondence, and the care of collections of lantern slides and photographs.

One of the assistants in the Bureau of Plant Industry library has, since January 1, revised all bibliographical lists accompanying papers

for the Journal of Agricultural Research. Similar bibliographical lists accompanying the various publications of the Bureau of Plant Industry, the Bureau of Entomology, the Dairy Division, and the Office of Markets and Rural Organization have been revised in the libraries of the respective offices. Much time was spent in the Bureau of Plant Industry library during the past year in the revision and reorganization of the mailing lists of the bureau.

A separate table is given at the end of this report, showing the approximate number of books and pamphlets contained in the various bureau, division, and office libraries, the number of current periodicals received for filing or review, the number of employees in each library, and the names of the librarians. Other statistics have been incorporated with the statistics of the main library.

Eight staff meetings, devoted principally to papers and discussions by the library staff, were held during the year from October to June. Another means of knitting together the library work of the department has been the temporary detail of assistants from the main library to the bureau, division, and office libraries and from the latter to the main library. It is believed that temporary appointments from the staffs of the State agricultural college and experiment station libraries would also be helpful in promoting cooperation between them and this library and would be a decided advantage in other respects.

The department was represented at the meeting of the American Library Association at Berkeley in June, 1915, by the librarian of the Office of Markets and Rural Organization and an assistant from the Bureau of Chemistry library. A paper on the relation of the State agricultural college and experiment station libraries to the library of this department was prepared by the librarian of the department for the meeting of the agricultural libraries section of the association. The object of the paper was to make somewhat better known the aim of this library, in its capacity as a national agricultural library, to be of service to other agricultural institutions and investigators throughout the country.

The following statistical summaries show in detail the work of the various divisions of the library:

# STATISTICAL SUMMARIES.

## FINANCES.

A comparison of the receipts and expenditures of the library for the last five years is given in the following table:

*Financial statement, fiscal years 1911 to 1915.*

## RECEIPTS.

Source of receipts and object of expenditure.	Fiscal year—				
	1911	1912	1913	1914	1915
Source:					
Library appropriation.....	\$35,320.00	\$40,500.00	\$41,280.00	\$43,520.00	\$45,360.00
Allotment from department printing and binding fund.....	12,420.72	12,813.95	13,843.31	11,345.84	10,190.62
Total.....	47,740.72	53,313.95	55,123.31	54,865.84	55,550.62

## EXPENDITURES.

Object:					
Books and serials.....	\$3,832.82	\$7,290.95	\$6,825.71	<sup>a</sup> \$9,100.00	<sup>a</sup> \$3,512.15
Periodicals.....	3,192.01	3,694.00	3,606.48	<sup>a</sup> 4,232.41	<sup>a</sup> 3,511.18
Index cards.....	224.44	146.89	215.86	168.03	181.56
Supplies and repairs.....	112.97	150.32	313.27	556.93	384.55
Furniture, shelving, and miscellaneous equipment.....	1,247.96	1,000.20	2,643.89	904.73	3,112.18
Travelling expenses.....	30.50	97.98	29.52		
Salaries (main library).....	21,576.16	27,848.17	27,140.27	28,377.17	27,798.00
	35,216.86	40,228.51	40,775.00	43,339.28	43,499.62
Printing.....	3,676.34	3,307.54	4,084.21	1,892.25	1,895.47
Binding.....	8,744.38	9,506.41	9,759.10	9,453.59	8,295.15
	12,420.72	12,813.95	13,843.31	11,345.84	10,190.62
Total.....	47,637.58	53,042.46	54,618.31	54,685.12	53,690.24

<sup>a</sup> Approximate figures.

## USE OF THE LIBRARY.

*Books and periodicals charged by the main library and the bureau, division, and office libraries during the fiscal years 1914 and 1915.*

Library.	Number of books charged—								Number of current periodicals.	
	To individuals.		To main library.		To branch libraries.		Total.			
	1914	1915	1914	1915	1914	1915	1914	1915	1914	1915
Main library.....	15,686	16,067	.....	.....	23,193	24,886	38,879	40,953	87,000	a 75,000
Bureau of Chemistry.....	8,646	9,373	846	817	69	61	9,561	10,250	20,681	20,032
Bureau of Entomology.....	2,956	2,765	265	360	50	68	3,271	3,193	890	1,003
Forest Service.....	3,516	3,607	401	436	.....	3	3,917	8,314	2,915	4,268
Bureau of Plant Industry.....	12,388	11,688	609	595	80	148	13,137	12,431	40,082	40,318
Dairy Division.....	1,840	1,930	75	53	10	19	1,925	2,071	14,246	14,839
Office of Farm Management.....	2,287	2,753	3	3	2	2	2,287	2,758	5,088	6,652
Office of Public Roads.....	1,354	1,540	57	168	20	33	1,458	1,741	(b)	(b)
Total.....	48,673	49,723	2,247	2,437	23,404	25,220	74,425	81,711	170,902	162,112

<sup>a</sup> Approximate figures.

<sup>b</sup> No records kept.



*Statistics of circulation (main library), fiscal years 1913, 1914, and 1915.*

Item.	1913	1914	1915
Largest number of books charged on any day.....	203	214	268
Smallest number of books charged on any day.....	31	39	37
Largest number of books charged in any month.....	4,106	4,454	4,260
Smallest number of books charged in any month.....	2,269	2,083	2,567
Average number of books charged daily.....	121	126	134
Average number of books charged monthly.....	3,078	3,239	3,412

The statistics of circulation do not include a record of the books and periodicals used in the main library and in the bureau, division, and office libraries, but not charged at the loan desk. They also do not include a record of the use of the books filed in the libraries of the Bureau of Biological Survey, the Bureau of Crop Estimates, the Office of Experiment Stations, Office of Markets and Rural Organization, and the office of the solicitor, all of which have collections of considerable size but keep no statistics of circulation.

#### INTERLIBRARY LOANS.

The records of books lent by this library to institutions outside of Washington, and also the records of books borrowed by this library from other libraries, are given in the following tables:

*Record of books lent outside of Washington during the fiscal years 1911 to 1915.*

States, etc.	Fiscal year—					States, etc.	Fiscal year—				
	1910-11	1911-12	1912-13	1913-14	1914-15		1910-11	1911-12	1912-13	1913-14	1914-15
Alabama.....	8	.....	.....	3	3	New York.....	70	79	59	113	142
Arizona.....	5	8	7	6	4	North Carolina.....	38	25	35	30	48
Arkansas.....	2	1	.....	.....	2	North Dakota.....	18	4	6	11	3
California.....	8	15	19	27	26	Ohio.....	29	37	53	103	78
Colorado.....	7	15	9	12	27	Oklahoma.....	.....	.....	.....	1	.....
Connecticut.....	11	12	16	4	4	Oregon.....	38	36	54	44	51
Delaware.....	5	8	11	18	11	Pennsylvania.....	3	27	34	19	21
Florida.....	36	38	27	20	44	Rhode Island.....	.....	.....	.....	1	6
Georgia.....	4	7	1	14	15	South Carolina.....	1	2	5	1	1
Idaho.....	.....	.....	3	5	9	South Dakota.....	.....	.....	.....	.....	3
Illinois.....	11	2	6	12	7	Tennessee.....	13	9	16	26	20
Indiana.....	15	23	7	7	25	Texas.....	13	12	10	9	23
Iowa.....	13	9	36	24	63	Utah.....	.....	.....	.....	.....	8
Kansas.....	2	18	8	12	59	Vermont.....	8	.....	27	30	21
Kentucky.....	11	2	6	4	25	Virginia.....	15	50	52	54	32
Louisiana.....	2	.....	5	2	2	Washington.....	.....	13	3	14	8
Maine.....	25	4	7	11	8	West Virginia.....	1	14	10	2	12
Maryland.....	8	9	12	7	25	Wisconsin.....	37	32	89	31	38
Massachusetts.....	17	10	14	18	36	Wyoming.....	7	.....	5	.....	4
Michigan.....	6	20	37	35	22	Canada.....	1	11	2	.....	1
Minnesota.....	5	5	2	7	64	Hawaii.....	7	1	2	2	.....
Mississippi.....	8	3	4	3	4	Japan.....	1	.....	.....	.....	.....
Missouri.....	1	5	17	19	18	Mexico.....	2	.....	.....	.....	.....
Montana.....	2	2	15	13	5	Porto Rico.....	55	33	39	67	57
Nebraska.....	41	17	32	20	20	Canal Zone.....	.....	.....	.....	1	.....
New Hampshire.....	1	.....	8	5	3	Total.....	613	620	826	896	1,196
New Jersey.....	1	.....	1	24	83						
New Mexico.....	.....	.....	1	4	3						

*Summarized statement of books borrowed from other libraries.*

Item.	1913	1914	1915
Largest number of books borrowed from other libraries on any day.....	43	40	42
Smallest number of books borrowed from other libraries on any day.....	1	1	1
Largest number of books borrowed from other libraries in any month.....	731	564	579
Smallest number of books borrowed from other libraries in any month.....	314	253	376
Average number of books borrowed from other libraries daily.....	18	16	18
Average number of books borrowed from other libraries monthly.....	480	432	460
Number of books borrowed during the year from libraries outside of Washington.....	91	62	58
Number of books borrowed during the year from other libraries in Washington.....	5,677	5,166	5,463
Total number of books borrowed from other libraries in and out of Washington.....	5,768	5,228	5,521

## ACCESSIONS.

The number of books, pamphlets, and maps added to the library during the fiscal year compared with the accessions of the four previous years is as follows:

*Accessions to the library for the fiscal years 1911, 1912, 1913, 1914, and 1915.*

Accessions.	1911	1912	1913	1914	1915
<b>Purchases:</b>					
Volumes.....	2,030	1,552	1,321	1,548	1,353
Pamphlets.....	89	77	51	41	39
Maps.....	1		1	1	
Photographs.....		10			
Serials and continuations.....	736	522	459	511	376
	2,856	2,161	1,832	2,101	1,768
<b>Gifts:</b>					
Volumes.....	614	907	886	719	959
Pamphlets.....	502	756	830	470	500
Maps.....	12	20	28	20	22
Continuations.....	3,463	3,560	4,425	4,490	4,909
	4,591	5,243	6,169	5,699	6,390
From binding periodicals and serials.....	1,369	1,718	1,573	1,826	1,085
<b>Total.....</b>	<b>8,816</b>	<b>9,122</b>	<b>9,574</b>	<b>9,626</b>	<b>9,243</b>

According to the record of accessions, the total number of accessioned books and pamphlets contained in the library on July 1, 1915, was 137,603, an increase of 4,557 over the preceding year. The difference between the increase in the number of accessioned books, pamphlets, and maps, namely, 4,557, and the total number of accessions for 1915 as shown in the table above, is due to the fact that the following were not accessioned—that is, numbered with the accession stamp: Unbound pamphlets of less than 25 pages, unbound serials not of sufficient size to bind separately, volumes of periodicals in temporary binders, and duplicate copies of a number of publications. From the total number of accessions, namely, 137,603, should, however, be deducted the 5,910 volumes which were discarded during the past year, leaving a balance of 131,693 books and pamphlets contained in the library on July 1, 1915.

## CATALOGUING DIVISION.

There were classified and catalogued 2,312 volumes, 539 pamphlets, 6,370 continuations, and 32 maps, making a total of 9,243, a decrease of 383 over the preceding year. In addition to the complete cataloguing of the above books, pamphlets, and maps, author cards were made for 596 pamphlets and 3,204 "reprints." The pamphlets for which only author cards are made are those of less importance. They are arranged by subject in a separate pamphlet collection. The "reprints," or "separates," of articles from periodicals are also filed in a separate collection which is arranged alphabetically by author. There were added to the main (dictionary) catalogue 24,380 cards, and 4,645 were withdrawn, making the net addition 19,735, a decrease of 890 as compared with the preceding year. It is estimated that the main (dictionary) catalogue now contains approximately 325,700 cards.

The number of titles prepared by the library for printing by the Library of Congress in what is known as the "Agr" series of catalogue cards, compared with the fiscal years 1912, 1913, and 1914, is as follows:

*Titles prepared for printing.*

Item.	1912	1913	1914	1915
Cards for accessions and recatalogued books .....	1,872	1,357	1,248	786
Cards for department publications .....	449	807	676	646
Cards for foreign agricultural periodicals .....	61	298	141	65
Total .....	2,382	2,462	2,065	1,463

The total number of titles prepared by this library since 1902, in which year the printing of cards was begun, is 27,048.

The amount of uncatalogued material on hand July 1, 1915, namely, 93 volumes, 359 pamphlets, 255 continuations, and 1 map, was considerably less than in the previous year.

## PERIODICAL DIVISION.

The total number of different periodicals (exclusive of annuals and serials of frequent issue) received currently during the year was 2,337, of which 819 were received by purchase and 1,518 by gift. The number of new periodicals added during the year was 295, whereas 90 of those received during the previous year either ceased publication or the subscriptions for them were discontinued, leaving a net increase for the year of 205. In order to facilitate the circulation of some of the periodicals, it was necessary to purchase 162 duplicates, making the total number of periodicals purchased 981. Of the periodicals received by gift and exchange, over 624 duplicates were received, making the total number of periodicals handled currently during the year 3,119. The distribution of the current periodicals by classes is shown in the following table:



*Statistics of current periodicals. <sup>a</sup>*

	Pur- chase.	Gift.	Total.		Pur- chase.	Gift.	Total.
Agriculture, United States...	9	197	206	Paper.....	10	1	11
Agriculture, foreign.....	32	249	281	Printing.....	1	.....	1
Veterinary medicine.....	32	36	68	Instruments.....	2	.....	2
Dairying.....	16	30	46	Photography.....	7	.....	7
Poultry and pigeons.....	7	46	53	Physics.....	6	1	7
Live stock and meat trade.....	9	49	58	Meteorology.....	1	.....	1
Soils and fertilizers.....	2	6	8	Chemistry and chemical tech- nology.....	83	17	100
Drainage and irrigation.....	2	1	3	Food.....	8	21	29
Farm implements and ma- chinery.....	3	11	14	Home economics.....	3	3	6
Moor culture and peat.....	2	2	4	Pharmacy.....	19	14	33
Agricultural products.....	35	41	76	Geology and mineralogy.....	3	11	14
Fibers and textiles.....	4	8	12	Natural history.....	12	42	54
Horticulture and landscape gardening.....	40	68	108	Zoology.....	20	9	29
Forestry and lumber.....	15	33	48	Hunting and fishing.....	11	7	18
Experiment station publica- tions (United States).....	.....	106	106	Ornithology.....	12	7	19
Experiment station publica- tions (foreign).....	1	33	34	Entomology.....	37	11	48
Law.....	9	.....	9	Beekeeping.....	7	4	11
Education.....	3	48	51	Microscopy.....	4	.....	4
Economics and sociology.....	14	22	36	Biology.....	16	3	19
Commerce and statistics.....	54	106	160	Medicine, physiology, and hygiene.....	56	56	112
Groceries.....	4	4	8	Bacteriology.....	9	2	11
Engineering.....	21	8	29	Botany.....	60	24	84
Building.....	7	4	11	General science.....	18	60	78
Roads.....	2	1	3	Geography.....	2	11	13
Railroads.....	12	5	17	General.....	10	10	20
Manufactures.....	31	15	46	United States Government documents (periodicals).....	2	35	37
Flour and feeding stuffs, mill- ing and baking.....	11	9	20	Bibliography and library economy.....	21	24	45
Ice and refrigeration.....	2	7	9	Total.....	819	1,518	2,337

<sup>a</sup> Annual reports, proceedings, and transactions not included.

In addition to the above current periodicals appearing not less than four times a year, the library received 5,285 serials of less frequent issue, such as annuals, annual reports, proceedings, and transactions published by institutions and societies.

## MISCELLANEOUS STATISTICS.

The number of books and periodicals sent to the Government bindery was 3,832, an increase of 470 as compared with the preceding year. In addition to the above books and periodicals, which were permanently bound, 2,281 were placed in temporary binders at the library, making a total of 6,113.

During the year two lists of duplicate publications were sent out to the Library of Congress and the various agricultural colleges and experiment stations. The publications selected from these lists filled about 50 mail bags.

The number of letters translated during the year was 302 and the number of articles 13.

The number of employees carried on the roll of the main library at the close of the year was 33; the number employed by the bureau, division, and office libraries was 33, a total of 66 in the main library and branches. This total includes librarians, library assistants, messengers, and charwomen.

The consolidated list, maintained by the Library, of all the addresses appearing on the various bureau and office foreign mailing lists for publications of the Department, comprises at the present time 3,127 addresses. This list is arranged geographically and may be called a foreign exchange list, as exchanges are received from a large proportion of the institutions and individuals included in the list.

## BUREAU, DIVISION, AND OFFICE LIBRARIES.

The approximate number of books and pamphlets contained in the various bureau, division, and office libraries is given in the following table, and also the number of current periodicals which are sent to them regularly for review or filing. For an account of the activities of these libraries during the past year see pages 3-5. For statistics in regard to the use of the books in the various branch libraries see page 6.

*Books, pamphlets, and periodicals in bureau, division, and office libraries.*

Name of library.	Librarian.	Number employed.	Approximate number of books and pamphlets.	Number of periodicals currently received.
Bureau of Animal Industry.....	Miss Elsie Moore.....	1	(a)	344
Bureau of Biological Survey.....	Mr. W. H. Cheesman.....	1	b 6,000	65
Bureau of Chemistry.....	Miss Anne E. Draper.....	4	11,500	400
Bureau of Crop Estimates.....	Miss Louise Hayward.....	2	b 10,000	335
Bureau of Entomology.....	Miss Mabel Colcord.....	1	14,100	250
Forest Service.....	Miss Helen E. Stockbridge.....	2	18,245	130
Bureau of Plant Industry.....	Miss Eunice R. Oberly.....	7	5,279	774
Dairy Division.....	Miss Margaret Doonan.....	3	2,190	331
Office of Experiment Stations.....	Miss E. Lucy Ogden.....	6	b 4,300	b 600
Office of Farm Management.....	Miss Cora L. Feldkamp.....	2	6,457	216
Office of Markets and Rural Organization.	Miss Caroline B. Sherman....	3	1,335	192
Office of Public Roads.....	Miss Grace Francis.....	1	b 6,000	131
Office of the solicitor.....	.....	.....	1,684	.....

<sup>a</sup> No separate library collections maintained.

<sup>b</sup> Approximate figures.

In connection with the above table showing the approximate number of books and pamphlets in the various libraries, it should perhaps be explained that the proportion of pamphlets in nearly all the collections is large.





## REPORT OF THE DIRECTOR OF THE OFFICE OF EXPERIMENT STATIONS.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
OFFICE OF EXPERIMENT STATIONS,  
*Washington, D. C., June 30, 1915.*

SIR: I have the honor to present herewith the report of the Office of Experiment Stations for the fiscal year ended June 30, 1915.

Respectfully,

A. C. TRUE, *Director.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### INTRODUCTION.

The work of the Office of Experiment Stations during the year ended June 30, 1915, as in previous years, dealt with (1) relations with agricultural experiment stations, (2) relations with agricultural schools and farmers' institutes, (3) maintenance of experiment stations in Alaska, Hawaii, Porto Rico, and Guam, (4) irrigation investigations, (5) drainage investigations, (6) home economics investigations, and (7) the preparation of publications relating to these lines of work. The work of the office was, however, increased and its functions materially modified as a result of the development of the policy of more closely coordinating the department's activities, particularly in the line of extension work in agriculture and home economics, with similar work by the State institutions, and by the transfer April 1, 1915, of supervision of farm demonstration work and farm home management work from the Bureau of Plant Industry to the office and of Irrigation and Drainage Investigations from this office to the Office of Public Roads, these preliminary steps being taken in anticipation of the reorganization of the office as the States Relations Service July 1, 1915.

### RELATIONS WITH AGRICULTURAL EXPERIMENT STATIONS.

The advisory and supervisory relations of the office with the agricultural experiment stations in the several States were maintained in accordance with provisions of the Hatch and Adams Acts. These relations have been of an intimate character, with a view to constructive assistance and the general advancement of the system of experiment stations. They have dealt with the work and general conditions at the stations as well as the supervision of the Federal funds. The activities of the office in this respect have been designed to strengthen the organization and the working force of the stations

as research institutions, to bring about conditions in the highest degree favorable to the station activities, and to improve the grade and the original character of the work. While seeing to it that the Federal funds were being strictly conserved for the purposes of experiment and investigation, the facilities of the office have been directed to the problem of making the investigations progressive and involved original features in order that when completed they may represent definite contributions.

The customary personal inspection of each of the experiment stations receiving Federal funds was made during the year, and a report covering their activities and general condition, including statistics as to their revenues, expenditures, and other similar data, was prepared for publication. Conferences with station officials and members of boards of control were frequently held during the year, and an active correspondence was maintained regarding questions of policy and the general progress of the work.

In these relations the effort has been to develop local initiative and the necessary measure of direction and to encourage in every way a strong and aggressive local organization. Unsettled conditions in a number of the States have called for unusual attention. In one instance it was necessary to withhold the Federal funds from the station pending the establishment of stable conditions which would insure the legal and proper use of the funds. In several other instances unsettled policy and lack of efficient organization have required special effort to establish internal relationships and proper understanding essential to the welfare and position of the station. Changes in directorship resulting in the bringing in of new men unfamiliar with the station work, and the temporary appointment of acting directors with little authority or responsibility, have hampered the stations for a time in some instances, and have required closer supervision and a larger measure of caution and advice. Many changes in the working forces of the stations, and increases due to the development of the work, have resulted in a large number of requests for assistance in filling these positions, which it has often been possible to render.

As heretofore, the office has passed upon and approved in advance the projects to be conducted under the Adams fund. This requires a large amount of careful attention, and often involves special study of the exact character of the investigation and the status of knowledge in that line. A reasonably high standard has been set for research under that fund, and the projects submitted have been examined in their relation to such a standard and their ability to yield original data and deductions. As the projects progress from year to year, modifications or restatements to make them more definite and effective are often required. During the year 88 new projects and 18 restatements or modifications of the work as originally accepted were approved. Where work on projects was conducted away from the station, as is sometimes necessary, some adequate means of supervision by the station authorities was required for the purpose of determining its needs and its general line of progress.

The effort of the department to provide a medium for the publication of the strictly scientific work of the stations, through the co-

operative administration of the Journal of Agricultural Research, has begun to bear fruit, and an increasing number of articles are furnished by the stations for publication in that journal. The Assistant Director of the office has continued to act as a member of the editorial committee in charge of this journal.

Much attention was devoted the past year by the office to the collection and preparation of the agricultural educational exhibit by the agricultural colleges and experiment stations at the Panama-Pacific International Exposition at San Francisco.

The general condition of the experiment stations the past year was excellent and represented steady advancement. They prospered in the extent and quality of their work and in the increased recognition of the value of research, as well as in the increased State and local appropriations for their maintenance. The sharper differentiation of their activities from those of the extension service, and the elimination of demonstration features, has gone far to clarify their function and to establish them in the public mind as research institutions.

Now that the importance of extension work in agriculture is being emphasized and kept before the public, it is essential that the necessity for maintaining the experiment stations as efficient sources of new knowledge should be generally recognized and acted upon. The office has therefore lately given relatively more attention to emphasizing the fundamental importance of the work of these institutions.

The work of the office in its relations with the experiment stations was in special charge of the Assistant Director, Dr. E. W. Allen.

#### RELATIONS WITH AGRICULTURAL SCHOOLS.

The movement for the introduction of agriculture into the curricula of schools throughout the country continues as rapidly as in preceding years. There were 1,677 schools, an increase of 263, reporting agricultural courses, with the number of pupils in such courses as 34,367, an increase of 4,552 over the previous year. With this growth of agricultural instruction in the schools there is an increased demand for aid relative to courses in elementary and secondary agriculture, suggestions as to laboratory equipment, illustrative material, and publications dealing with the various topics found in agricultural courses.

The office continued to cooperate with the Bureau of Education in the preparation of an annual report on the progress of agricultural education at home and abroad, including the statistics of the land-grant colleges, published in the Annual Report of the Commissioner of Education.

In cooperation with the State agricultural colleges, experiment stations, and State departments of education the office began the preparation of a series of bulletins on elementary agriculture for rural schools. Such bulletins have already been prepared for the schools of Alabama, Maryland, and Wisconsin. Other publications completed during the year dealt with correlating agriculture with the public-school subjects in the Northern and in the Southern States, exercises with plants and animals for southern rural schools, lessons on cotton for the rural common schools, school credit for home work



in agriculture, home projects in secondary agriculture, and judging draft horses and dairy cows as subjects of instruction in the secondary schools.

Beginning with January, 1915, five numbers of Volume I of the *Agricultural Education Monthly* were issued. This monthly contains items of general interest pertaining to methods of teaching agriculture in the secondary schools and furnishes references and suggestions upon timely topics suitable for subject matter.

At the request of the Southern Commission on Accredited High Schools the office has prepared outlines of courses covering one unit, two units, three units, and four units of agriculture for accredited high schools in the South. In cooperation with the American Association for the Advancement of Agricultural Teaching the office continued to study the problem of the use of land in the teaching of agriculture in secondary schools. The problem in agricultural education studied in cooperation with the Association of American Agricultural Colleges and Experiment Stations was the training of extension workers by the land-grant colleges.

Studies were completed dealing with the content of courses of instruction in home economics, with special reference to their development in relation to the betterment of rural homes and to agricultural conditions and products found in the environment of the schools.

The supply of illustrative material, especially lantern slides, for instructional purposes, was increased to meet the rapidly growing demand for such material, the large amount of valuable illustrative material available in the different bureaus of the department being drawn upon for this purpose.

This division of the work of the office was in charge of Mr. C. H. Lane, chief specialist in agricultural education.

#### FARMERS' INSTITUTES AND MOVABLE SCHOOLS.

As heretofore, information regarding farmers' institutes, movable schools, and special agricultural meetings in the United States, also notes on agricultural extension work in foreign countries were collected and published.

The special form of movable schools devised by this office, whereby community groups of farm men and women meet for study under the leadership of one of their number, has been further tested during the year. This form of extension work has been found so promising of good results that several courses are being prepared for this use on both agricultural and home economics subjects. These courses will be introduced in cooperation with agricultural colleges which will furnish the necessary library, laboratory equipment, and supplies, and conduct the examinations.

The preparation of syllabi of lectures on agricultural and home economics subjects, illustrated by appropriate sets of lantern slides, which are loaned for purposes of instruction among rural people, was continued. In this and other ways the office has aided the extension departments of agricultural colleges, the State departments of agriculture, the agricultural high schools, and other schools teaching agriculture, the county agricultural demonstrators, and numerous local organizations in their extension work. The loan of these

lectures and slides has proven a useful service, and much effort has been made to increase the list of lectures and improve the slides in every way possible.

This division of the work of the office remained in charge of Mr. J. M. Stedman, as farmers' institute specialist.

### PUBLICATIONS.

The office issued during the year 58 documents, aggregating 3,569 pages. These included 21 numbers of Experiment Station Record, 2 reports, 9 technical bulletins, 5 Farmers' Bulletins, 11 publications of the insular stations, 3 Yearbook articles, and 7 miscellaneous documents. These publications, reflecting the activities of the office, dealt with the work and expenditures of the State experiment stations; the diversified operations of the experiment stations in Alaska, Hawaii, Porto Rico, and Guam; methods and materials of instruction in agriculture; cooperative extension work in agriculture and home economics; Federal laws, regulations, and rulings affecting the agricultural colleges and experiment stations; lists of college, station, and extension workers in agriculture and home economics in the United States; irrigation structures, methods, and practice; progress of reclamation by drainage of swamp and overflowed lands; and foods and household equipment.

Volumes XXXI and XXXII of Experiment Station Record, each consisting of nine numbers and the usual author and subject indexes, were prepared during the year, in accordance with the general plan in operation for several years. These volumes contained 7,800 abstracts of the world's scientific literature pertaining to agriculture, together with monthly editorials discussing important phases of the development of agricultural investigation and science, and brief notes on the progress of institutions for agricultural education and research in this country and abroad.

The editorial management of the Record remained in charge of Dr. E. W. Allen. The other publication work of the office was in charge of Mr. W. H. Beal.

### WORK OF STATES RELATIONS COMMITTEE.

In consequence of the passage of the agricultural extension act of May 8, 1914, the administration of which is given to the Secretary of Agriculture, a committee was appointed by the Secretary to carry out the provisions of this act. Since the act provided for cooperative relations between the department and the State agricultural colleges in demonstration and extension work in agriculture and home economics, it was deemed highly desirable to coordinate all the work of the different bureaus of the department in these lines with similar work of the agricultural colleges and to enter into general cooperative arrangements with the colleges, under which the department would work through them in all its extension activities. The making of such arrangements was intrusted to the committee, which was designated the States Relation Committee. Its members were the Director and Assistant Director of the office and the two officers of the Bureau of Plant Industry in charge of

farmers' cooperative demonstration work, Messrs. Bradford Knapp and C. B. Smith. A memorandum of agreement between the Secretary of Agriculture and the presidents or deans of the agricultural colleges was drawn up and adopted by practically all the States. The assent of all the States to the provisions of the agricultural extension act was obtained and an organization for the administration of funds granted to the agricultural colleges under this act, as well as of the other funds intrusted to those institutions for extension work, was formed in all the State colleges. These organizations practically establish divisions of agricultural extension in the colleges, which resemble and are coordinate with the agricultural experiment stations and have at their head directors of extension work corresponding to the directors of the experiment stations. Through the extension divisions of the colleges a large number of projects for cooperative extension work in a great variety of lines have been formulated and agreed upon under the general memorandum of agreement. Whenever these projects involved the expenditure of Smith-Lever funds they have been submitted to and passed upon by the committee. The appropriation act of March 4, 1915, provided that in the reorganization of the work of the department, on July 1, 1915, the farmers' cooperative demonstration work should become a part of the States Relations Service, and that the Director of this service should have general charge of all cooperative agricultural extension relations.

Pending this reorganization the Secretary gave to the States Relations Committee the administrative control of the demonstration work and funds, subject to the limitations of the appropriation act for the fiscal year 1915. In this way a large amount of work relating to the demonstrations was conducted by the committee during the last quarter of the year, including arrangements for the transfer of the demonstration force to the States Relations Service on July 1, 1915.

Much time was spent during the past year in determining more exactly the fields which may properly be occupied by the demonstration and extension work under Federal and State legislation and the relations of such work to the county and local organizations. Conferences were held with officers of the State agricultural colleges and representatives of the county governments and local organizations with a view to establishing more complete and cordial cooperative relations. The field forces of the department and the colleges engaged in extension work have been brought into more definite and satisfactory relations. In general the development of the organization of a great unified system of practical instruction for farming people along the various branches of agriculture and home economics under State and National auspices to cover the entire country has been greatly advanced. The way has thus been prepared for the successful operation of the permanent agency which is to conduct the Federal business connected with the cooperative agricultural extension system.

#### INSULAR STATIONS.

The work of the several insular stations proceeded along about the same lines as formerly, crop diversification being the central idea of all the investigations.



There were a number of changes in the personnel of some of the stations, but there were no serious interruptions in the work. A plant breeder was added to the staff of the Alaska stations, and that work, which has been in progress for several years, will be featured more than formerly.

The relations of the stations with those for whom they are working continues to be satisfactory in the main. The demand for advice, cooperative and demonstration work, publications, etc., is growing rapidly, and the requests have in some instances exceeded the ability of the stations to comply with them. More funds are needed for nearly every station in order to provide for the normal extension of the work. The loss of the sales funds, which had been available for the maintenance of the stations for a number of years, in the absence of any compensating appropriation, will necessitate a curtailing of some of the work. The appropriation of the Hawaii Legislature of \$5,000, which has been available for several years for demonstration work by the station, has been withdrawn, but an increased fund was set aside for the cooperative marketing work, which is continued under the auspices of the station.

An important feature of the work of the insular stations has been the cooperative aid given by the various bureaus of this department. This service has been of great value and without it some features of the stations' activities would have been greatly curtailed.

The appropriations for the insular stations for the fiscal year 1915 were: Alaska, \$40,000; Hawaii, \$35,000; Porto Rico, \$30,000; and Guam, \$15,000. These sums were increased by sales funds as follows: Alaska, \$7,823.11; Hawaii, \$1,181.79; Porto Rico, \$3,928.79; and Guam, \$548.21. For the cooperative marketing work in Hawaii \$13,500 was expended. In addition, local contributions amounting to \$1,642.70 were available for the use of the station.

The administrative work in relation to this office and the review of their financial affairs continue, as formerly, under the charge of Dr. Walter H. Evans and the accounting division of this office.

#### ALASKA STATIONS.

The ripening of many of the grains in the summer of 1914 was retarded by prolonged cloudy weather and an unusual amount of rain. In 1915 the spring opened earlier and the summer followed with more sunshine and less rain than normal. Along the southeastern coast this condition was unusually favorable to crops of all kinds, but in portions of the interior it almost amounted to a drought. As a result the growth of grass and grain crops was short and the yields reduced, although the quality was good. Harvest was earlier than usual and practically all varieties of grains matured. Even spring wheat, which has been the least successfully grown of any of the cereals, was fully ripened.

At the Sitka station the efforts at plant breeding are being continued and numerous crosses of strawberries, raspberries, currants, apples, etc., have been made and the resultant hybrids will be given thorough trial. The work with hybrid strawberries is still in progress and many of the least desirable ones have been eliminated. The others are being critically studied to determine which ones appear to

possess the most promise for Alaskan conditions. The unusual weather had a marked effect on the fruit trees, and nearly all varieties of apples grown at the station promise to produce fruit this season. The cooperative work with settlers is being extended, and in addition to the distribution of seeds the Sitka station sent out 4,400 fruit trees and fruit bushes to 126 addresses in different parts of the Territory. In addition, large numbers of small plants, cuttings, etc., were distributed. A number of plant diseases made their appearance in the nursery during 1915, but they readily yielded to control by spraying.

The general conditions at the Rampart station were similar to those at Sitka. Seeding was finished earlier than usual and the early growth of crops of all kinds began favorably. The later development was retarded somewhat, though no serious injury followed the drought. Grain of all kinds, including several varieties of spring wheat, matured, and winter rye produced a good crop. Winter wheat ripened, but the stand was poor, owing to winterkilling. The yellow-flowered Siberian alfalfa (*Medicago falcata*), *Trifolium lupinaster*, and *Vicia cracca* matured fine crops and produced abundant seed. A marked variation in the seedlings of some of these forage plants has been noticed and advantage is being taken of this to secure more vigorous, hardier, and more productive strains of these important plants. The hybridization work with cereals and alfalfa has been extended beyond what was previously possible, by reason of the presence of an assistant at this station.

The work at the Fairbanks station suffered considerably by reason of the drought, and only partial successes are reported for all crops. Hay crops were light and the straw of grain crops was short, but on the north slopes of bench land good returns are reported for grain and potatoes. A considerable planting of Petrowski turnips was made for seed purposes and a light crop of seed for distribution was secured. This variety continues to be one of the most valuable for Alaskan conditions through its immunity to attacks of the root maggot.

At the Kodiak station, where forage production for the live stock is being given special consideration, the dry summer severely curtailed the growth of pasture, hay, and silage crops. The dry weather, accompanied with high winds, interfered with the pasture renewal experiments, as the light volcanic ash was blown away, leaving the roots of the plants bare. The live stock has done well and there has been a normal increase of both cattle and sheep. Considerable trouble has been experienced on account of the brown bears, more than one-half the sheep and several of the cattle having been killed during the past year. This necessitates constant herding during the day and strong inclosures for night protection.

With the announcement of the route for the railroad from Seward to Fairbanks a rapid influx of settlers into this region followed. As the climate and soils of the Matanuska and Seward Valleys differ materially from those at the several stations already established, it was believed desirable to provide for the establishment of an experiment station in this region. A scientist who has been connected with the Alaska stations made an agricultural survey of the region and selected a tract of 240 acres as a site for an experiment station near the junction of the Matanuska Branch with the main line of the rail-

road, and its reservation as an experiment station has been asked for. The development of this station will be dependent on future appropriations, the present funds for the Alaska investigations being inadequate to provide for any new enterprises.

#### HAWAII STATION.

One of the important accomplishments of the past year was the organization of the extension and demonstration work by the station, as provided for by Congress. This work is of the highest importance at this time, for while the conditions on the larger sugar and pineapple plantations are very satisfactory, those of the cultivator of small tracts of land are deplorable. The small farmers are not receiving the proportionally increased price for their cane that the market would justify, and the prices offered for their pineapples are much lower than the estimated cost of production. The extension service is attempting to bring about a wider diversification of crops, and, through cooperative associations, to market the produce of the small farmers and purchase their necessities. There are a number of industries that are agriculturally possible in Hawaii, but it remains to show that they may be made economically profitable. The station is the only agency that has consistently stood for diversified agriculture, and, if the Territory is to produce its food rather than depend for it upon importations, this work should be considerably extended.

The investigations of the station have been continued along about the same lines as formerly reported, and some of the results have been published. The studies of the soils of Hawaii, their origin, chemical and physical characteristics, biological relations, and methods of management, which were begun several years ago, have been brought to a close, and a series of bulletins on various phases of the subject have been issued. The conclusions regarding the proper use of fertilizers are quite definite, and if more generally adopted they would doubtless considerably increase crop yields.

A survey of the forage plants of the Territory has been made in cooperation with various ranchers, and a bulletin issued describing the more important species that have been tested, with suggestions for their proper management.

An extensive test of green manure crops and forage plants is in progress at the station to determine their adaptability and relative efficiency. September seedings of jack beans and velvet beans have given higher yields of seed and green matter than did seeding at any other time. An introduced plant, *Crotalaria sultiana*, that has become widely disseminated in the islands, has been found valuable as a green manure plant, and its sowing as an intercrop with cane and rubber has been extensively practiced. A demonstration of the value of leguminous crops grown in rotation with pineapples is in progress at Haiku, on the island of Maui. Among the forage-plant experiments tests of a number of varieties of alfalfa have been made, and those from Spain, Kansas, and Utah have outyielded both Turkestan and Peruvian strains where grown without irrigation and with an annual rainfall of only about 20 inches. Sudan grass, both for soiling and hay, has proved one of the most valuable of the station's



introductions, and the plantings of this grass have been considerably extended. At the Glenwood substation large yields of honohono have been secured as a soiling crop for dairy cows, and the practicability of the use of cane tops for silage has been fully demonstrated. The silage kept well and was relished by cattle.

The station continues to distribute valuable seeds and plants throughout the islands, and during the year many thousands of cuttings of hibiscus hybrids were sent out for planting as ornamental hedges, a large proportion of them going to Fort Shafter and Schofield Barracks for the ornamentation of their grounds. Variety tests of different agricultural and horticultural crops and experiments in the best methods of handling them are in progress at the station, the results of which will be disseminated widely through the extension and demonstration service.

As a result of preliminary investigations by several members of the station staff, the practicability of the use of arsenite of soda for the suppression of weeds, especially in pineapple and cane fields, has been definitely established.

#### PORTO RICO STATION.

During the past fiscal year the activities of the station have been continued along the principal lines enumerated in previous reports. The new plant house erected from insular funds has been put in use and valuable results have already been secured through this agency. The analytical and plat work conducted by the chemist and assistant chemist have been considerably extended. The experiments with sugar cane on red clay soils that included the study of more than 300 plats have been brought to a close and the results are being prepared for publication. As a result of the investigations of the station it is now possible to give definite information regarding the fertilizing of the cane crops on this type of soil. The survey of the island for deposits of bat guanos has been continued, and more than 40 caves have been explored. About 150 samples of bat guanos have been analyzed in the laboratory. These samples run from 5 to 30 per cent phosphoric acid and from 0.025 to 8 per cent nitrogen. Vegetation experiments are in progress to determine the availability of this phosphoric acid. The chemical work on lime-induced chlorosis has been continued, the investigations including studies on the iron nutrition of rice, selective absorption by the roots of plants, and the composition of the ash of rice at different stages of growth.

The cooperative work in the fertilization of citrus orchards has been brought to a close and the results published. It was found that nitrogen was the limiting factor in all cases, with phosphoric acid next in importance. For the lighter rolling lands on the northern coast a complete fertilizer gave the best results. In a similar way experiments have shown that nitrogen was the important lacking element required for the more profitable production of coffee and cane. Field experiments showed largely increased yields where fertilizers have been properly used. In connection with the improvement of the soil, extensive experiments have been conducted with leguminous cover crops, and a number of introduced as well as some native species have been found well adapted to the purpose. Some of the most

desirable ones are being grown at the station and the seed is distributed for growing among cane, orchard, and other crops. An attempt is being made to induce the laborers on plantations to plant some of the quick-growing varieties of beans for the food obtained, while the planter at the same time receives the benefit of the cover crop and the nitrogen which has been taken from the air.

The experiments on the supposed deterioration of vegetables grown from northern seed have been in progress for six years, and no deterioration due to environment has been observed in beans, tomatoes, okra, peppers, and lettuce. The coffee varieties under investigation have been extended to include Guillon, Bourbon, robusta, and several selected strains of individual plants. The seed of the best of these is being distributed to planters. A study on the adaptability of certain types of soils to coffee production has been completed within the year, and the results of the investigation are being compiled for publication. Some interest has been manifest in vanilla production, and the station has sent out cuttings to planters who will undertake the growing of this crop. The mango collection has been extended to include about 60 varieties, and several thousand trees of the better varieties have been distributed. With the accessibility of good markets the growing of this and other tropical fruits for export should become an important industry. Other important horticultural work includes selection and fertilizer experiments with coconuts, methods for growing root crops, the introduction, testing, and distribution of economic plants, etc.

The entomological work for the past year has included a study of coffee insects, the life history of the changa or mole cricket, insect pests of vegetables, and beekeeping. In connection with the latter there has been an extensive distribution of honey-yielding plants to regions where they are not already abundant.

The work on the introduction and breeding of live stock has been continued along the original lines, and the station has built up a valuable herd of dairy cattle, containing Guernsey, Jersey, and Shorthorn breeds.

There is an urgent need in Porto Rico for demonstration and extension work among the people of the island. The station has a large amount of data concerning agricultural and horticultural practices that would be of value if more generally adopted. There are at present no adequate means for disseminating this information, and one of the most pressing needs is for more funds, so that this work can be taken up by the station in a thorough, systematic manner.

#### GUAM STATION.

During the past year considerable attention has been given to preparing the newly acquired land at Cotot for experimental purposes. A large amount of fencing has been completed and arrangements have been made for caring for most of the live stock at this place, the central station not having enough land for pasture and forage production in addition to the area devoted to experimental purposes. A number of minor improvements and repairs were made to the station buildings. A new water supply was secured through the digging of a large well, which at the end of the dry season yielded 9,000

gallons of water daily—an amount sufficient to more than supply the present needs of the station.

With the acquisition of the Cotot farm, arrangements were made to transfer most of the live stock to that place. An attempt is being made to keep cattle under improved conditions as to range, etc., and a considerable area has been planted to introduced grasses to supplement the native pastures. On account of the presence of cattle ticks in Guam and the effect of their presence on the breeding stock, an experiment in tick eradication has been begun, with apparently promising results. Experiments are in progress in stock feeding, all kinds of native and station-grown feed being compared with standard feeds shipped from the States. It is intended by these experiments to thoroughly test all available sources of feeding stuffs, determine their deficiencies, and learn how they may be profitably supplemented.

The field-crop work has been largely selection breeding of corn, preliminary experiments with cotton, and forage-crop investigations. Ear to row tests are in progress, with selections of corn, by which earlier maturity, greater uniformity, and better yields are sought. In the cotton work a number of varieties of upland, sea island, and Arizona-Egyptian types were tested, the largest yield—1,641 pounds of seed cotton per acre—being obtained from the Yuma variety of Arizona-Egyptian. Incidentally the late arrival of some of the varieties showed the importance of early seeding, a later planting of the Yuma variety yielding only 512 pounds of seed cotton. As a result of this experiment, 10 bushels of Arizona-Egyptian cotton seed has been sent to Guam for distribution among the natives. The forage-crop investigations include Para grass (*Panicum molle*), *Paspalum dilatatum*, sorghums, kafir corn, feterita, and various leguminous plants, especially cowpeas and soy beans. The value of Para grass and Paspalum, introduced several years ago by the station, was emphasized, as they were about the only grasses to yield forage during the unusually prolonged dry season.

A large amount of attention is being given to the introduction of seeds and plants to extend the range of valuable tropical economic plants in Guam, the office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry heartily cooperating in this work. The distribution of station-grown seeds and plants that have been shown adapted to cultivation in Guam has been considerably extended, more than 4,000 lots being sent out during the year. Through an arrangement with the insular authorities the proper planting and care of these crops is assured.

The breeding work with horses, cattle, hogs, goats, and chickens has been continued along the same lines as formerly reported, and several pure-bred and grade animals have been added to the station herds and flocks through natural increase. No new stock has been purchased, but the necessity of acquiring new blood is recognized, and some additional breeding animals will be secured as soon as opportunity for their transportation is offered.

The veterinarian has begun a study of some of the live-stock diseases prevalent in Guam, with a view to their possible control. Among those reported upon are investigations of cattle ticks, liver flukes of cattle, hogs, and goats, stomach worms of cattle, kidney or lard worms of hogs, lungworms of hogs, and various diseases and internal and external parasites of poultry.



The apicultural work has been considerably extended, and, through the cooperation of the governor of the island, instruction in beekeeping is given in the schools in conjunction with school-garden work. The station has supplied nuclei, which are to be increased until every school is provided with colonies of its own.

The relations of the station with the various departments of the island government are satisfactory. On the whole, the station enjoys the confidence and good will of the naval authorities and the native inhabitants of the island to an increasing extent.

### IRRIGATION INVESTIGATIONS.

During the year the work of irrigation investigations continued to be largely devoted to scientific and technical studies, the leading subjects being the best practice in applying water to crops, as to time of application, quantity applied, and methods of applying; the measurement of irrigation water; the flow of water in canals and pipes; pumping for irrigation; and the operation of irrigation districts and mutual and cooperative canal companies.

The investigation of use of water in irrigation, made during the season of 1914, consisted in field and plat experiments to determine the effect of applying different quantities of water to crops, tank experiments to get more accurate results where conditions were largely under control, and soil-moisture determinations in the field to ascertain what part of the moisture applied in irrigation remained within the zone of plant roots and was therefore of use to the plants. The results of all these investigations tended to show that with the heavy irrigations usually given crops much of the water is lost by deep percolation. This suggested that equally good results might be obtained with the use of much less water if methods of applying the water, the quantities used, and the time between applications could be adapted more carefully to the various types of soil. Consequently the investigations of 1915 along this line have dealt principally with the movements of soil moisture and the adapting of irrigation practice to soil conditions. It is believed that in this line of adapting irrigation practice to soil conditions lie great possibilities for both economy of water and increased crop returns.

The experiments with measuring devices at the hydraulic laboratory at the Colorado agricultural college have been continued throughout the year. Reports of these experiments containing discharge curves and tables for various types of weirs have been prepared for publication, and two new types of measuring devices have been designed and calibrated. It is believed that these will be found useful under conditions where weirs of the standard types can not be used. At the New Mexico experiment station experiments with a submerged orifice have been made and a report giving the results has been approved for publication by that station. At the Davis farm of the University of California all the measuring devices commonly used in that State have been calibrated against standard weirs and the results have been published by the university. Other devices not in common use have also been tested at the Davis farm to determine their value under California conditions.

The investigations of the flow of water in canals and other conduits, begun in the previous year, have been continued. A bulletin

giving the results of the work on the flow of water in open channels has been published during the year; the results of similar work on the flow in wood pipes have been compiled, and observations on concrete pipes have been begun. These experiments have proven to be of great value to hydraulic engineers by giving them more accurate data for the designing of new conduits.

Pumping investigations for the year have consisted in mechanical tests in the laboratory of the New Mexico experiment station, mechanical tests in the field in Idaho, Kansas, and Nebraska, and the collection of data on the cost of operation and maintenance of Work on a general bulletin on pumping for irrigation has continued.

Studies of the operation of irrigation districts have continued. These studies have for their primary object the improvement in district legislation in such a way as to make district bonds more salable. The investigations of the operation of mutual and co-operative irrigation enterprises were continued, and reports of these investigations are in preparation.

The irrigation investigations remained in direct charge of Dr. Samuel Fortier.

#### GENERAL REVIEW OF IRRIGATION INVESTIGATIONS, 1898-1915.

By order of the Secretary, on April 1, 1915, this work was placed under the general supervision of the Director of the Office of Public Roads, in anticipation of its transfer to the new Office of Public Roads and Rural Engineering on July 1. By this transfer the irrigation work of the office came to an end. This work was first provided for in 1898, and has been carried on continuously since that time. While many phases of irrigation have been studied during these 17 years, two problems have been foremost. When the work started the greatest need of the arid region seemed to be a reform in the legislation relating to irrigation in the several States containing arid land. Consequently much effort was devoted to studying the needs of the arid region in this regard and urging better laws. Largely through the efforts of the office most of the arid States have adopted codes of laws relating to irrigation conforming to the general principles urged in the earlier publications of the office. Next to the need for improved legislation seemed to be the need for a more economical use of water. The water supply of the arid region is sufficient for only a small part of the land which is arable except for the lack of water, while large areas are being ruined by excess water from irrigation. Therefore studies to determine first how much water was being used, then how much should be used, and methods of preventing waste and encouraging economical use have been a leading line of investigation.

These studies have involved many others, both engineering and economic. An intelligent use of water in irrigation requires that the water be measured, and any general adoption of the practice of measuring water requires inexpensive and simple measuring devices. Since satisfactory methods of measuring water for irrigation had not been developed, considerable attention was given to this subject. A hydraulic laboratory used exclusively for this purpose has been established in cooperation with the Colorado agricultural college, at Fort Collins, where existing measuring devices have been calibrated and new devices developed.



Measurements of water diverted from streams and that delivered for use disclosed very large losses of water in transit from stream to farm. Studies to determine the location and magnitude of these losses and means of preventing them have been carried on and the results published, resulting in great improvement in all classes of conduits and the saving of much water.

It has been found that the types of contracts and regulations governing the use of water have a large influence on the quantity of water used; that is, on the disposition of the irrigator to use water economically or wastefully, and much has been done to promote the adoption of regulations which will encourage economy of water.

Along with the investigational work outlined above, the office has carried on extension work, devoting considerable time to personal advice to farmers and publishing a large number of bulletins giving practical direction for the guidance of irrigators, and describing structures of various kinds for the use of irrigation engineers. Several recent textbooks on irrigation are based almost wholly on the publications of this office, and the same is true of several foreign publications recently received.

### DRAINAGE INVESTIGATIONS.

Drainage work was carried on during the year in all of the arid States and in practically all those of the humid section with the exception of the New England States. The investigations were in general similar in character to those of the last several years. They included the preparation of plans for improving (1) farm lands already under cultivation but too wet to produce maximum yields; (2) tracts of swamp and marsh which under present conditions can only be classed as waste land; (3) agricultural land that is subject to periodic overflow by streams; (4) land in the arid West or in part unproductive owing to the rise of ground water and consequent concentration of alkali near the surface; and (5) technical investigations.

As regards farm lands already under cultivation, the resources of the office were severely taxed to meet the growing demand for advice and assistance in the installation of tile drainage systems. In certain parts of the South, notably North Carolina and Alabama, the economic value of tile drainage is now generally recognized, while in the other Southern States, perhaps more especially in Maryland and Virginia, the growing appreciation of this form of improvement is very encouraging. A representative of the office was constantly available in each of the Southern States to those seeking assistance in tile draining their land and in preventing hillside erosion. In a large number of cases complete surveys were made and plans worked out in detail.

The improvement of tracts of permanent swamp and marsh was an important phase of the work. Such tracts, especially in the South, often compose the bottom lands adjoining a stream which is so shallow and otherwise inefficient as at no time to afford adequate drainage to the adjacent land. The largest project of this nature on which surveys and plans were made during the year was the Cowcastle Swamp drainage district, Orangeburg County, S. C., containing 42,350 acres.



A number of projects involving the protection of land injured by periodic overflow of streams were taken up during the year. The most prominent among these, and for which detailed plans have been prepared, are the Mayfield Creek and Diamond Island Bend projects, in western Kentucky, the areas involved being 25,000 and 4,500 acres, respectively. A survey of the Panther Creek drainage district, containing approximately 60,000 acres, in Daviess County, Ky., was undertaken near the close of the fiscal year. A complete drainage survey of the portion of the Kootenai River Valley between the international boundary and the town of Crossport, Idaho, including about 40,000 acres, was made in accordance with an agreement with the proposed Kootenai River drainage district.

The work in the arid West was carried on during the entire year by nine commissioned men permanently located in the irrigated sections, who devoted their time to overcoming the difficulties involved in the rise of ground water due to irrigation and to the collection of the technical data essential to the proper solution of these problems. The active assistance rendered by these men was in the nature of suggesting measures for the abatement of seepage and alkali conditions on individual tracts ranging in size from only a few acres to several thousand acres. An example of the latter class was the Maricopa drainage district No. 1, Maricopa County, Ariz. For this district, which contains 9,320 acres, complete drainage plans were prepared. Much work of this nature was done in the Rio Grande Valley, Tex., the Grand and Arkansas Valleys, Colo., and the Yakima Valley, Wash.

Technical research in the field of drainage formed an important part of the work of the office during the year, both in the Eastern section and in the arid West. Stream measurements, for the determination of the proper coefficients of run-off and ditch flow, were carried on during the winter and spring in North Carolina, Mississippi, and Arkansas. Construction was started on a plant at Arlington Farm, Va., to be used for extensive experiments on the flow of water in drain tile. Investigations of run-off and of the cost of draining by the use of pumps were continued in southern Louisiana, and the results compiled and distributed. A study was also made of this method of drainage in the upper Mississippi Valley, and steps were taken preliminary to carrying on extended investigations of this nature in Florida. The collection of data relating to the discharge from tile drains was continued.

Investigations relating to the construction, maintenance, and cost of drainage works was completed and a report on this subject prepared. Investigations with regard to the manufacture and use of cement tile were continued.

In the irrigated sections, studies were continued in various States, notably in Washington and Idaho, in the determination of the discharge to be provided for by drainage works. Cooperative work with the California Agricultural Experiment Station was continued in the effort to ascertain the efficiency of underdrains in the removal of alkali. Joint investigations with the Bureau of Standards relative to the durability of cement tile in alkali soil were also continued.

Manuscript was prepared for a bulletin summarizing the seven years' work of the office in the Grand Valley, Colo. Bulletins

on the subject of tile drainage also were prepared for publication by the States of North Carolina, Virginia, and Alabama.

S. H. McCrory, chief of drainage investigations, had direct charge of the work throughout the year.

#### GENERAL REVIEW OF DRAINAGE INVESTIGATIONS, 1902-1915.

On April 1, 1915, general supervision of the drainage investigations was transferred to the Office of Public Roads. In less than 13 years from the appointment of the first drainage expert, the staff increased to 27 engineers and the scope and influence of the drainage work increased correspondingly. Drainage investigations are largely responsible for introducing tile drainage into the Southern States, from Maryland to Texas, for the amount of such work that had been done previously was quite inconsiderable and the people generally in those States were without knowledge of how their wet fields might be made more productive through this means. A great number of farms in that section are now underdrained and State institutions acting either in cooperation with the office or independently have undertaken the work of informing those interested in agriculture concerning the advantages of drainage and the proper methods for controlling soil water.

A most significant result of the drainage work is the fact that since 1909 at least eight States where our drainage engineers have been established have passed general laws providing for the establishment of drainage districts and for financing those districts through the one practical method of issuing bonds that are a lien upon the lands benefited. These laws have been enacted at the desire of land-owners who have learned something of the value of drainage, the magnitude of the necessary reclamation works, and the methods of organization necessary. Under these laws hundreds of drainage districts have been organized, about fourscore in North Carolina alone, and hundreds of thousands of acres of swamp and overflowed lands have been drained for cultivation.

The peculiar problems of drainage for reclaiming irrigated lands, injured by seepage and alkali, in the so-called arid States, have engaged the attention of the office since the beginning of the drainage work. Satisfactory progress has been made toward understanding these problems and their solution, and in introducing efficient methods of protection or reclamation by drainage.

The engineering data collected and the published discussions of the engineering problems are serving a constantly increasing number of engineers and communities in planning improvements and designing drainage structures.

#### HOME ECONOMICS INVESTIGATIONS.

The work of the year in this division of the office was broader in scope than heretofore, since it included studies of clothing, household equipment, and household labor, as well as food and nutrition.

An experimental study of the nutritive value and digestibility of culinary and table fats showed that they are very thoroughly assimilated, although those with high melting point, like suet and

tallow, are a little less thoroughly digested than those with low melting point, like lard and butter. Kafir corn, milo maize, feterita meal and other products were found to compare favorably with similar corn products in digestibility of their carbohydrates. Their protein was not quite so thoroughly assimilated. Palatable dishes can be made from these grains and their use will help to make the diet varied. For this and similar reasons such grains are worthy of more extended use in the region where they are grown and elsewhere. Studies of honey showed many new and improved ways of using it in the home in the preparation of palatable dishes. Work was also carried on regarding the preparation of rice for the table and its place in the diet, and household uses of citrus and other fruits.

As a result of studies of spots and stains and their removal from clothing and household textiles, methods were found which will greatly aid the housekeeper in the care of such materials. Similar studies regarding the cleaning and care of other household equipment are in progress. The studies of household labor undertaken with the respiration calorimeter proved in general that the choice of equipment is an important matter, making it clear that poor equipment means a loss of labor and furnishing data to show how great the loss is. Of the types of labor so far studied (dish-washing and sewing), the former makes decidedly greater demands on the worker's strength than the latter. A noteworthy feature of such experiments is that they yield quantitative data and so make it possible to discuss such questions with a greater degree of accuracy than has hitherto been possible.

In addition to the above, which represent the more important features of the work, the usual routine matters received attention.

The publications issued included a Yearbook article on the selection of household equipment and two Farmers' Bulletins, one on kitchen arrangement and equipment and the other on honey.

As in previous years, the home economics investigations were in charge of Dr. C. F. Langworthy.



## REPORT OF THE DIRECTOR OF THE OFFICE OF PUBLIC ROADS.

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U. S. DEPARTMENT OF AGRICULTURE,  
OFFICE OF PUBLIC ROADS AND RURAL ENGINEERING,  
*Washington, D. C., August 27, 1915.*

SIR: I have the honor to submit herewith the report of the Office of Public Roads for the fiscal year ended June 30, 1915.

Respectfully,

L. W. PAGE, *Director.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### INTRODUCTION.

In accordance with the act of Congress dated March 4, 1915, making appropriation for the Department of Agriculture for the fiscal year 1916, and effecting reorganization of certain branches of the work, the Divisions of Drainage and Irrigation, from the Office of Experiment Stations, and the farm architectural work from the Office of Farm Management Investigations, were to combine on July 1, 1915, with the Office of Public Roads, under the new branch designated as the Office of Public Roads and Rural Engineering. Preparatory to this consolidation, the Secretary of Agriculture authorized the Director of the Office of Public Roads to assume supervision of the four branches named, on April 1, 1915, in order that the work of coordinating administrative details might be accomplished and the work under the reorganization be in actual progress at the commencement of the fiscal year 1916.

The four branches were accordingly removed during the month of May into necessarily larger office quarters in the Willard Building, Washington, D. C.; the clerical forces were combined in one working unit; the number of the engineering field quarters was reduced from 32 to 3, to be located at Denver, Colo., New Orleans, La., and Berkeley, Cal. The total working force, therefore, under the supervision of the Director of the Office of Public Roads on June 30, 1915, was 450, of which number 288 were on the rolls of the Office of Public Roads, the remaining 162 having been brought in under the other branches.

### GENERAL WORK OF THE YEAR.

Under the names of their respective divisions, the work of the divisions of Drainage, Irrigation, and Farm Architecture since April

1, 1915, is given later in this report, while their usual yearly report will be given in the reports of the offices of their former chiefs.

The total appropriation for the Office of Public Roads for the fiscal year was \$352,560, of which \$52,500 was for the statutory roll and \$300,060 was for general expenses. The office was still engaged during the year in supervising the expenditure of \$500,000 appropriated by Congress for the Post Office Department, to be spent in the improvement of post roads, in addition to double that amount provided by the county or State in which the respective roads are located. The total number of square yards of road construction supervised by various divisions of the office this year has been nearly four times that of last year.

### FIELD ENGINEERING.

As in last year's report, the field engineering work is under immediate direction of the Assistant Director, and comprises the following subactivities: Division of Construction, Division of Maintenance, and Division of National Park and Forest Roads. This divisional arrangement of the field engineering work is for convenience in management, but is elastic as to personnel, since the same engineers are used interchangeably in the several divisions.

#### DIVISION OF CONSTRUCTION.

VERNON M. PEIRCE, *Chief.*

A large proportion of the engineering force of this division has been engaged during the past year on post-road projects. As a result several of the standing projects of the office have been temporarily curtailed. The operations of this division in detail are reported as follows:

#### OBJECT-LESSON ROADS.

Object-lesson roads are constructed, upon application of township and county authorities, to demonstrate proper methods of construction and the proper use of road-building materials. The office furnishes the services of an engineer, and the local communities are required to furnish all materials, labor, and supplies.

Sixteen object-lesson roads were completed, and according to location and type were as follows: Arkansas, gravel, 1. Florida, oil-sand, 1; bituminous macadam, 2. Georgia, sand-clay, 1. Indiana, sand-clay, 1. Mississippi, gravel, 1. North Carolina, earth, 1; top soil, 1. Oklahoma, earth, 3. Tennessee, earth, 1. Texas, gravel, 1; earth, 1. South Carolina, gravel, 1.

#### EXPERIMENTAL ROADS.

Experimental roads are constructed to determine the relative merits and values of the various types of road construction, and of the various preparations and materials for use in road construction. In certain instances the office pays only a portion of the cost of these roads, since the balance is borne by the county in which the road is located. The cost of such roads built this year was charged in whole or in part against the \$60,000 appropriated for this purpose.

One experimental oil-coralline rock road at Buena Vista, Fla., was completed. Plans were prepared and contracts let for constructing a section of the Mount Vernon Road,  $4\frac{1}{2}$  miles in length, and a section of the Russell Road, about three-fourths mile in length, both in Alexandria county, Va. Twenty-six experimental sections are being constructed on these two roads and a detailed description of them will be given in a special circular which will be issued about March 1, 1916.

#### POST ROADS.

Of the 17 post-road projects mentioned in the last annual report as having been selected by the Postmaster General and the Secretary of Agriculture pursuant to the provisions of the Post Office appropriation act of August 24, 1912, but one had been completed. Work was continued this year on these roads, and five were completed, as follows: Iowa, Boone and Story Counties; Maryland, Montgomery County; Oregon, Jackson County; Virginia, Fairfax County; and Virginia, Spotsylvania, Caroline, and Hanover Counties. The total length of the five completed this year is 153 miles. Work progressed satisfactorily on the remaining 11 roads, practically all of which were 75 per cent completed at the close of the fiscal year. The appropriation act provided that a detailed report of this project should be made to Congress, which will be done as soon as all the roads are completed.

#### BRIDGE WORK.

Bridge designs were prepared for the following locations: California, 1; Kentucky, 6; North Carolina, 1; South Carolina, 5; and Virginia, 2. General designs and specifications for steel bridges prepared by State highway departments, also designs prepared by bridge companies for local communities, were examined and reviewed as an assistance to local officials. Nineteen inspections were made during the fiscal year 1915, in connection with which local officials were advised regarding their problems on bridges and culverts.

#### COUNTY ROAD SYSTEMS.

Systems of roads were planned and recommendations made as to the best methods of improving them for the following counties: Calcasieu Parish, La., Alachua County, Fla., and Albemarle County, Va.

#### SUPERINTENDENCE OF COUNTY ROADS.

To demonstrate the advantages derived by having road construction supervised by a skilled highway engineer, a senior highway engineer in charge of a post road in Fairfax County has, in cooperation with the State highway department of Virginia, also supervised the construction of about 34 miles of gravel road in that county.

#### INSPECTION AND ADVICE.

Engineers were assigned to study specific road problems and to give advice relative to their solution to local officials as follows: Arizona, 1; Colorado, 1; Georgia, 1; Indiana, 4; Kentucky, 2; Louisiana, 4; Maine, 1; Maryland, 1; Massachusetts, 1; Mississippi, 1; Missouri, 1; Nebraska, 1; North Carolina, 2; Oklahoma, 2; Pennsylvania, 1; Rhode Island, 1; South Carolina, 1; Tennessee, 3; Texas, 4;



and Virginia, 6. In addition to the above, three engineers have been assigned to assist the State highway department of Kentucky in its State-aid work, and an engineer has been assigned to assist the State geologist of Georgia in an examination of the various road-building materials of the State.

## INSTRUCTION IN HIGHWAY ENGINEERING.

The policy of this office to give a postgraduate course in highway engineering to graduates in civil engineering has been continued. From an eligible list established through competitive examination six graduates were selected and have been given practical instruction in the field and laboratories in addition to a course of lectures on materials, construction, and road economics.

## SQUARE YARDS OF ROADS CONSTRUCTED UNDER OFFICE SUPERVISION.

The following table shows the number of square yards of each type of road constructed during the past 10 fiscal years, 1906 to 1915, inclusive:

*Area, in square yards, of roads constructed during the fiscal years 1906-1915, inclusive.*

Material.	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915
Brick.....					526			2,055		
Concrete.....					1,004			3,013	782	149,333
Oil-cement concrete.....						1,917		1,744		
Bituminous concrete.....								2,898		
Bituminous - surfaced concrete.....								4,178		
Bituminous macadam.....					45,832	41,551	34,453	16,040	10,033	150,131
Surface treatment.....								6,386	15,911	
Macadam.....	51,246	76,376	72,587	96,107	50,333	11,330	14,806	57,131	168,156	154,742
Asphalt-slag.....						578				
Oil-asphalt gravel.....						900				
Oil-gravel.....					4,819	9,774				
Gravel-macadam.....								2,607		
Gravel.....	4,197	11,722	4,608	65,793	71,376	59,942	13,057	63,730	255,945	548,102
Slag.....					4,610					
Sand-clay.....	19,443	85,571	42,634	205,032	177,960	218,177	103,876	128,496	86,715	3,568
Sand-gumbo.....								5,337		
Burnt clay.....			3,392	2,041						
Shell.....	933		14,020	1,630				43,717		
Earth.....	12,132	27,042	85,967	319,456	651,109	140,933	556,663	162,696	127,495	273,469
Top soil.....									26,498	985,584
Oil-sand.....										1,333
Total.....	87,951	200,711	223,208	690,059	1,007,569	485,102	722,855	500,028	691,535	2,266,662

From the above table it is seen that during this year the engineers of this division have supervised the construction of 2,266,662 square yards of road, or 257.5 miles, assuming all roads surfaced to have been 15 feet in width.

## ROAD MAINTENANCE.

E. W. JAMES, *Chief.*

The operations of this division during the fiscal year were conducted under 5 projects which are mentioned below in detail:

## STUDIES OF STATE MAINTENANCE.

Studies in detail of the technical methods of road maintenance were made in selected sections of Massachusetts, New York, New

Hampshire, and southern Connecticut. These studies, so far as they have gone, indicate that they are likely to be of much value in making the office a clearing-house of information regarding the details of maintenance work.

#### STUDIES OF COUNTY MAINTENANCE.

The study of maintenance in those States where all work is under the county unit furnished little of an instructive nature, but revealed the need of some adequate system of handling road work so as to insure practical maintenance of county roads. Work has, therefore, been started to develop an effective system of procedure along this line.

#### MAINTENANCE OF COMPLETED POST ROADS.

In order to observe the best methods of maintaining a considerable mileage of bituminous and concrete road and to secure maintenance costs where construction has been immediately under the supervision of the office in all details, maintenance will be continued beyond the period required to obtain the data asked for by Congress on certain of the post-roads built under supervision of this office. The Maryland post-road, 5.4 miles in length, has been selected as one of these roads, and arrangements have been practically completed to carry on continuous maintenance of this road for an indefinite period. Similar arrangements are also being made for maintenance of the Texas, Ohio, and Maine post roads as soon as they are completed, which will probably be in the fall of 1915.

#### OBJECT-LESSON MAINTENANCE ON WASHINGTON-ATLANTA HIGHWAY.

The demonstration maintenance work on the road from Washington to Atlanta has been most successful in educating the local authorities in methods of work and in convincing them of the economical and financial value of maintaining roads for the construction of which large sums of public money have been spent. The work of supervising maintenance was undertaken only in counties which had made formal application and had agreed to accept the supervision of the engineer assigned and to allot for the work a definite sum per mile, to be expended only on the approval of the engineer. Out of the total of 1,037.8 miles of this highway, 723.7 miles are now under the supervision of this office.

The need of construction over a large part of the through road was almost everywhere apparent and counties were encouraged to build their links of the road. In this construction work the office furnished every assistance possible and provided a special engineer in addition to the three engaged mainly on maintenance work. As a result of these efforts \$101,819.85 has been spent on this construction work under supervision of the office during the fiscal year.

For convenience in the work, this highway has been divided into the Northern, Central, and Southern divisions. An engineer has been assigned to each division and furnished with an automobile leased from the American Highway Association, with which this office is co-operating in this project. In the operation of the automobiles opportunity has been furnished to secure very exact and complete cost data, which form the basis for a future report comparing the costs of road supervision using livery and that using motors.

## EXPERIMENTAL MAINTENANCE OF SELECTED ROADS.

During the year experimental earth-road maintenance has been conducted on about 8 miles of road in Alexandria County, Va. The data secured has closely checked that secured in the two preceding years and contract with the county for cooperation will not be renewed.

The experimental maintenance work has been continued in Montgomery County, Md., on the Rockville Pike and Bradley Lane, which are bituminous macadam, surface-treated; and on the Chevy Chase experimental road, which includes sections of bituminous macadam by both the mixed and penetration methods, as well as sections of brick and various kinds of concrete construction.

Using reports from the traffic censuses conducted by the Division of Road Economics according to the French method in connection with the data obtained under this project, the two sets of data thus provided are being used to develop a system of expressing maintenance costs on a basis of the ton-miles of traffic. These studies will be continued with the view to expanding the scope of this system so that the traffic limits may be found between which a given road surface is more economical in the long run than any other. The total mileage under observation during the fiscal year was 11.02 miles, and construction of other experimental sections during the same period, together with the surface treatment of the Montgomery County post road for experimental purposes, will increase the mileage next year to 22.7.

The traffic census in Montgomery County indicates a weight of traffic for 6 months ending June 30, 1915, almost equal to that of the entire traffic during the calendar year 1914. This increase of traffic necessarily has increased the cost of the experimental maintenance and has made the entire reconstruction of the bituminous surface of Bradley Lane necessary. This work was begun during the fiscal year, but has not yet been completed.

Arrangements are being made to cooperate with four counties in Florida in maintaining the road from Brooksville to St. Petersburg and from Fort Myers to Punta Rassa under similar conditions of cooperation as those prevailing on the Washington-Atlanta Road.

## NATIONAL PARK AND FOREST ROADS.

T. WARREN ALLEN, *Chief*.

This division has charge of certain road work in national parks, in cooperation with the Department of the Interior, and of road work in the National Forests, in cooperation with the Forest Service of the Department of Agriculture. The work accomplished during the year follows:

## NATIONAL PARK ROADS.

*Arkansas Hot Springs Reservation.*—An inspection of road conditions was completed.

*Wind Cave National Park.*—An inspection of road conditions was made.

*Rainier National Park.*—After an inspection of road conditions was made, a consultation was held with the superintendent of the park and recommendations made as to the best methods to take in widening the road for automobile use from Longmire Springs to Paradise Park.



*Glacier National Park.*—A location survey was made and plans prepared for the Fish Creek-McGees Meadow Road, which will be 5 miles long. A 4-mile location survey was made of the Lake McDonald West Side Road. Recommendations were made to the superintendent of the park in regard to the construction of an earth road along the easterly side of Lower St. Mary Lake.

*Sequoia National Park.*—A 10-mile location survey was made for a road from Giant Forest to the north park boundary near J. O. Pass. Plans for about 3 miles of this road were completed.

*Yosemite National Park.*—The topographical survey for the village to be located on the floor of the valley was finished during this year and plans showing the results were prepared. Considerable reconnaissance work was done to obtain information necessary in working up plans for a complete road system. An inspection and report was made on the work of widening the Wawona Road to permit of automobile traffic. The survey was completed for the improved road from the park entrance near El Portal to Yosemite Village. A 16-mile extension of this road was also surveyed, going above Nevada Falls and into the valley of the Little Yosemite. Plans for the first 5 miles of this road have been completed, as well as a great part of the plans for the remainder.

#### NATIONAL FOREST ROADS.

In six Forest Service districts plans were prepared for approved road projects and construction work was carried on in all, with the exception of California, where the difficulties encountered necessitated some delay. The work, by States, follows:

*Colorado.*—Work was done on three projects and repair work on one. Reconnaissance surveys were made on four projects, one of which lies partly in Wyoming. Location surveys were made on two projects for next year's construction work.

*Wyoming.*—Construction work was done on one project and a location survey made on one for next year's construction.

*South Dakota.*—Construction work was carried out on one project.

*Montana.*—Construction was completed on three projects and begun on one other.

*Idaho.*—Construction work was done on three projects.

*Utah.*—One construction project was carried on and considerable repair work was done on others.

*Arizona.*—Location surveys were made on three projects.

*New Mexico.*—Location surveys were made on two projects and construction begun on one.

*California.*—One location and 12 reconnaissance surveys were made.

*Oregon.*—Construction work was done on four projects.

*Washington.*—Construction work was done on two projects.

#### ECONOMIC AND STATISTICAL WORK.

The Division of Road Economics, under J. E. Pennybacker, chief, is carrying out certain branches of work, given in detail as follows:

##### GENERAL STATISTICAL AND RESEARCH INVESTIGATIONS.

The most important subactivity under this project during the year has been the collection of data on mileage of improved and unimproved roads, taxation for road purposes, expenditures, and bond issues for the year 1914. This investigation embraces every county and township in the United States, and is in line with similar investigations conducted in 1904 and 1909. At the close of the fiscal year the investigation was about 50 per cent completed.

The collection and compilation of current data through the medium of monthly reports by a corps of State collaborators has been continued throughout the year, and from these reports a State index,

showing the progress and status of road improvement in each State, has been maintained by the office.

#### COUNTY ECONOMIC STUDIES.

The studies begun in 1910 and completed in 1914 for the purpose of determining the economic results of road improvement in eight selected counties were in manuscript form ready for publication at the close of the year, but were held for some additional information on assessed values of land in 1915. The bulletin will be issued before the close of the calendar year 1915.

#### STUDIES OF STATE HIGHWAY SYSTEMS.

Studies of the organization, methods of operation, and results accomplished in the various State highway departments were continued during the year, and the work was completed in the New England States, New York, New Jersey, Pennsylvania, Delaware, and Kentucky, the purpose of the project being to issue a report or bulletin as soon as studies have been completed for all of the States having highway departments.

#### STUDIES OF COUNTY ROAD MANAGEMENT.

The investigation begun in 1914 of road management in selected counties throughout the United States has been continued throughout the year, and the project was about 40 per cent completed on June 30, 1915. County and township studies had been completed on that date in Maine, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Indiana, Missouri, Texas, and Montana. The ultimate purpose of this project is to issue a series of bulletins explanatory of the systems of road management prevailing in the various local units throughout the United States, and indicating the lines along which best results may be obtained.

#### ECONOMIC STUDY OF POST ROADS.

Economic studies on each of the 17 post roads constructed under authority of the act of Congress of August 24, 1912, have been made, and in some instances a second or final study has been made after the completion of the improvement. These studies will all be completed in the calendar year 1915, and will be embodied in a report to be transmitted to Congress covering the post-road improvement.

#### TRAFFIC STUDIES.

A census of traffic has been taken on each of the 17 post roads for a period of one week at 3-months intervals and an additional week during the crop-moving period. The purpose of these traffic counts is to determine the annual traffic on the road before and after improvement, expressed in ton-miles. It is planned that the traffic counts on the post roads will be discontinued as rapidly as these facts are ascertained.

The census of traffic on the experimental roads constructed by this office is taken for a 24-hour period every thirteenth day. At

the close of the fiscal year traffic studies were in operation on the following roads: The Chevy Chase experimental road and the Rockville experimental road, both in Montgomery County, Md.; the Mount Vernon Avenue experimental road and the Russell experimental road, both in Alexandria County, Va.

These traffic studies are designed to indicate the relative traffic importance of the roads improved and the cost per ton-mile of traffic represented by the outlay for construction, maintenance, and depreciation. The financial burden thus incurred is measured against the saving per ton-mile by reason of increased loads, greater hauling radius, and increase in the speed for hauling. The traffic census also indicates the effect of the various kinds and volumes of traffic upon the several types of construction represented in the post and experimental roads. It is purposed to embody the data thus obtained in a publication to be issued later on.

#### STUDIES OF CONVICT LABOR IN ROAD CONSTRUCTION.

During the past year an exhaustive study was made, in cooperation with the United States Public Health Service, of convict road camps and convict road work in every part of the United States. These studies had been completed at the close of the fiscal year and the preparation of a manuscript for a comprehensive bulletin on the subject was under way.

As a result of the studies it was considered highly desirable that an experimental convict camp be established at some suitable point, at which the conclusions reached in the nation-wide study could be demonstrated practically. To this end the project was discussed with various State and county officials. At the close of the year it seems quite probable that Fulton County, Ga., would establish such a camp and conduct it under the observation and in accordance with suggestions of this office and the United States Public Health Service.

#### LECTURES, ADDRESSES, AND PAPERS.

In its advisory work under this division the office cooperated with the State highway department of Kentucky through the assignment of an engineer to aid in the preliminary work of organization and the installation of the necessary system of report and record incident to the operation of the recent State-aid law. Advice by personal conferences was given to committees of the North Carolina State Legislature in connection with the recent passage of the bill establishing a State highway department, and advice was given in connection with similar legislation in Tennessee. Other advisory work in connection with county organization and management was given during the year.

During the year 410 lectures and addresses were delivered in 38 of the States by 32 representatives of the various divisions of the office, as compared with 331 lectures in 1914. The total attendance was 58,352. These lectures were given mostly at farmers' meetings, road conventions, and gatherings of civic and scientific organizations. A number of papers were read and lectures given in 10 States at colleges and universities, and before road schools held at universities or colleges. These road schools were attended largely by local



road officials and afforded excellent means of conveying to such officials needed information.

#### MODELS AND EXHIBITS.

Exhibits consisting of models and enlarged photographs illustrating the best method of road, bridge, and culvert construction; road drainage, maintenance, repair, and roadway treatment; and road-building machinery and equipment have been made during the year at expositions, congresses, conventions, and fairs.

Exhibits furnished by the office were made during the year at the following places, under the auspices of the organizations named:

American Road Congress, Atlanta, Ga.  
 Annual Convention of American Road Builders' Association, Chicago.  
 Annual Convention of Peoria County Good Roads Association, Peoria, Ill.  
 International Dry Farming Congress, Wichita, Kans.  
 Boston Domestic Science and Pure Food Exposition, Boston, Mass.  
 Seventh Annual Convention, Michigan Good Roads Association, Grand Rapids, Mich.  
 Montana Road Congress, Great Falls, Mont.  
 Northwestern Road Congress, Milwaukee, Wis.  
 Civic and Industrial Exhibition, Norwalk, Conn.  
 State Fair, Louisville, Ky.  
 State Exposition, Portland, Me.  
 West Michigan State Fair, Grand Rapids, Mich.  
 Ohio-Michigan Land Show, Toledo, Ohio.  
 State Fair, Columbus, Ohio.  
 National Sportsmen's Show, New York City.  
 Panama-Pacific Exposition, San Francisco, Cal.  
 Annual Convention of Arkansas Press Association, Harrison, Ark.

In addition, exhibits were made at the West Virginia State University, Morgantown, W. Va., during the road school; at Indianapolis, Ind., in the State Capitol, during the session of the legislature for the months of January and February; and during the session of the legislature in Little Rock, Ark. Models have also been on exhibition under the auspices of the State highway department at Montgomery, Ala.

The total estimated attendance of persons who examined the exhibits at the various gatherings was 440,438, as against 300,000 during the year 1914. The cost of installation, drayage, freight, and repacking was paid by the exposition companies or other organizations, except in the case of the exhibit at Wichita, Kans., where all expenses were paid out of a special fund appropriated by Congress.

#### PHOTOGRAPHIC WORK AND PREPARATION OF MODELS.

In the photographic laboratory 3,304 negatives, 13,250 prints, 2,418 lantern slides, 198 bromide enlargements, 64 vandyke prints, and 10,502 blue prints were prepared. The negatives on file in the office at the close of the fiscal year numbered 12,995. During the year 2,017 lantern slides were colored. In the reclassification of the lantern-slide files a number of the slides were discarded as obsolete and a number have been damaged in shipments of loan collections, leaving 6,992 slides now in the office collection. Fifty-four sets of slides have been loaned this fiscal year, exclusive of those used in lectures given by employees of the office.

During the fiscal year 28 new models were constructed for the Panama-Pacific Exposition at San Francisco, among which were included a model showing road relocation and a model showing roadside treatment. In addition, 14 other new models were constructed and old models were repaired as necessary.

#### PUBLICATIONS.

Four publications were issued, as follows: Department Bulletin No. 136, "Highway Bonds;" Report of the Director of the Office of Public Roads for the fiscal year 1914; Department Bulletin No. 220, "Road Models;" Circular No. 49 of the Office of the Secretary, "Motor Vehicle Registrations and Revenues, 1914." Three other manuscripts and two revisions of bulletins were prepared and in press during this fiscal year, and will be issued shortly as Department Bulletins, namely: "Vitrified Brick Pavements for Country Roads;" "Portland Cement Concrete Pavements for Country Roads;" "Oil-Mixed Portland Cement Concrete;" "Progress Reports of Experiments in Dust Prevention and Road Preservation, 1914;" "Construction and Maintenance of Roads and Bridges, from July 1, 1913, to December 31, 1914." Manuscript of an article on State Road Management for the 1914 Agricultural Yearbook was also prepared.

#### INVESTIGATION OF ROAD MATERIALS.

During the year a total of 1,049 samples were received by the physical and chemical testing laboratories to be examined to determine their suitability for road-building purposes. This is an increase of nearly 15 per cent over the number received during the preceding year.

#### PHYSICAL TESTS.

The physical testing laboratory, under the supervision of E. B. McCormick, mechanical engineer, received 630 samples, classified as follows: Gravel, 153; limestone, 86; dolomite, 48; granite, 37; sandstone, 31; cement, 22; gneiss, 20; diabase, 19; sand, 18; concrete, 18; clay, 15; schist, 11; miscellaneous, including samples of marl, shell, slag, etc., 77; samples on hand and unclassified July 1, 1915, 75.

States from which the largest number of samples were received are as follows: Texas, 66; Virginia, 62; Ohio, 28; Tennessee, 27; Indiana, 26; Iowa, 23; Illinois, 22; Maryland, 20; West Virginia, 19.

Research into the road-building qualities of gravel was carried on throughout the year. An investigation of the present cementing-value test, for the purpose of determining the uniformity of results obtainable, was also carried out. The effect of frost on the strength of rock and cement mortar was studied by means of the refrigeration machine installed in the laboratory.

Concrete investigations, including the effect of vibration on the strength and time of setting of cement mortars and concrete, and a continuation of the concrete bridge-slab experiments, were carried on. Observations of the changes in length occurring in concrete roads under different weather conditions have been continued. Considerable work was also done on the standardization of tests for concrete

aggregates in cooperation with the American Society for Testing Materials.

Instructions in the work done by the physical laboratories were given during the year to six civil-engineer students.

#### CHEMICAL INVESTIGATIONS.

The work of the chemical and petrographic laboratories has been carried out under the supervision of C. S. Reeve, chemist. During the fiscal year 419 samples were examined in the chemical laboratory, representing the largest amount of work in its history and an increase of 28 per cent over the number of samples received the previous year. Whereas formerly the bulk of the routine work consisted in the examination of samples from outside sources, the increase in the volume of construction and maintenance work coming directly under the supervision of the office has necessitated the examination of numerous samples for the purpose of controlling the products used. For those cases where the quantity of the product warrants it, a system of inspection at the plant of the manufacturer has been organized. The following inspections were cared for in this manner:

Oil asphalt for Maine post road.....	gallons..	453, 830
Oil asphalt for Mount Vernon avenue experimental road.....	do.....	41, 500
Fluxed native asphalt for Mount Vernon avenue experimental road .....	gallons..	41, 500
Culvert metal for Maine post road.....	sheets..	1, 102
Culvert metal for Fairfax County, Va., post road.....	do.....	448
Culvert metal for Texas post road.....	do.....	737

Continued study has been given to Florida conditions with a view to further utilization of local materials, and more particularly for the purpose of developing forms of bituminous sand construction. Under laboratory supervision mixed bituminous sand sections were constructed at West Palm Beach and Ocala, Fla., and a short section by the layer method was laid at Jupiter, Fla. The laboratory also supervised construction of additional oil-coralline rock and oil-marl sections at Buena Vista and Ocala, respectively. The results obtained to date in the latter type of construction now form the basis of definite recommendations for extensive work of this character.

Papers on "Determination of the value of bituminous construction" and "Maintenance cost system used on United States experimental road" were issued from the laboratory. The latter was prepared in cooperation with the Division of Maintenance.

Research work has been continued along the lines indicated in the last annual report and, while results of value have been obtained, they are not sufficiently complete to warrant immediate publication. Additional work has been undertaken for the purpose of devising, if possible, a more practical standard needle for the penetration test, and to thoroughly study the effect of the method of preparing the sample upon the values obtained in this test. Methods of improving the fixed carbon test to make it applicable to materials which foam are also under investigation. The bulletin on methods of testing bituminous road materials is partially revised and will be published at an early date.

The petrographic laboratory examined and classified 536 samples of rocks for road building, making a grand total of 955 samples



which passed through this division, or a total increase of 10 per cent over the work of the previous year. This was accomplished without any increase in the working force. A revision of the bulletin on rocks for road building, with considerable new matter, has been prepared for publication.

During the fiscal year instruction in the work of the chemical and petrographic laboratories has been given to 1 senior highway engineer of the office, 7 civil engineer students, and 3 representatives from State universities or technical schools.

#### FIELD EXPERIMENTS.

E. B. McCORMICK, *Mechanical Engineer.*

Traction tests have been continued. The object of these tests is to determine the actual effect of road improvement on draft, and also the effect of width of tire, of diameter of wheels, and of method of hitching on draft. Final tests have been completed on projects in Iowa (Ames), Maryland, and Alabama. Preliminary tests have been made on projects in Iowa (Dubuque), Texas, South Carolina, North Carolina, and Virginia (Arlington). These projects range from 5 to 75 miles in length, and reports are in process of compilation on the projects in Iowa (Ames), Alabama, and Maryland.

In the securing of information in regard to the effect of different types and conditions of road surfaces on the draft of self-propelled vehicles, no commercial type of dynamometer has been found satisfactory for this work, and the office has found it necessary to design and construct one to fulfill its own particular conditions. This has been done and the dynamometer is being tried out experimentally.

#### DIVISIONS ADDED UNDER REORGANIZATION.

##### DRAINAGE INVESTIGATIONS.

S. H. McCROY, *Chief.*

Since April 1, 1915, a gradual rearrangement has been made in administrative details, to fit the drainage work to the organization of the Office of Public Roads and Rural Engineering and to coordinate it with the work of the other divisions.

The work of drainage investigations for this year is reported by the Director of the Office of Experiment Stations. The principal investigations since April 1 include the examination of peat and muck lands in Florida and in States north of the Ohio River; a survey of the overflowed lands on Panther Creek, in Daviess County, Ky.; and the gaugings of the Kootenai River in northern Idaho to estimate the rate of flood flow that must be accommodated by drainage improvements to reclaim the overflowed lands along that river. The installation of a pumping plant and other equipment has been made on the Arlington Experiment Farm, Virginia, to determine by laboratory methods the carrying capacity of drains having various rates of fall. Plans have been made for a careful study of the laws and regulations governing the organization of drainage districts; the methods of financing such organizations, particularly the requirements for making drainage bonds readily salable; and the laws governing the rights of drainage districts and other indi-

viduals or communities to change the natural course or rate of flow from a drainage basin.

The reorganization of the department does not contemplate any material change in the scope of drainage investigations work. Greater emphasis will be laid upon the research investigations; and the extension work will be correlated with that of other bureaus of the department.

#### FARM IRRIGATION INVESTIGATIONS.

SAMUEL FORTIER, *Chief.*

In the act providing for the reorganization of the department the wording of the clause providing for irrigation investigations was modified, but the law did not change materially the work to be done, merely defining it more specifically and making it relate more directly to farm irrigation. There were no changes in personnel or in the general organization for directing the work. In view of the segregation of the extension work in the reorganization of the department it has seemed advisable to confine the work of this division more closely than heretofore to research. This change has led to a change in the organization of the field work, which heretofore has been administered on a territorial basis. Under the new plan it will be handled on a subject basis, and the local offices heretofore maintained in the several States will be abandoned, and the men will work from three central field offices or from Washington. The work for the field season of 1915 was outlined and begun under the supervision of this office, and consists principally of a continuation of studies of duty of water, measurement of water, pumping for irrigation, and economic questions relating to irrigation. The work of this division for this fiscal year is given in the report of the Director of the Office of Experiment Stations.

#### DIVISION OF RURAL ENGINEERING.

The farm architectural work, formerly under the Office of Farm Management Investigations, was placed under the supervision of the Office of Public Roads on April 1, 1915. There was no change in the personnel engaged on that work, but it was designated as one project of the new work of rural engineering to be taken up under the new organization. This work since April 1 has followed activities which had been planned in the Office of Farm Management Investigations, and, in addition, the administrative details of the work have been coordinated with that of the new organization. The report of work for the fiscal year will be included in that of the Office of Farm Management Investigations.

Preliminary steps were taken toward combining the architectural work and certain features of the work of other divisions of a rural engineering character to form a division of rural engineering, of which E. B. McCormick has been designated chief. All work of a rural-engineering character which was planned to come under the jurisdiction of the office officially on July 1 was informally placed under Mr. McCormick's direction as of April 1.

## REPORT OF THE SOLICITOR.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
OFFICE OF THE SOLICITOR,  
*Washington, D. C., October 1, 1915.*

SIR: I submit herewith the report of the work of the Office of the Solicitor for the fiscal year ended June 30, 1915.

Respectfully,

FRANCIS G. CAFFEY,  
*Solicitor.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### SUMMARY.

Three phases of the work of this office during the fiscal year 1915 are notable: (1) Organization of a section to handle legal questions relating to marketing and rural economics; (2) circulation throughout the department of formal opinions of the Solicitor, rendered upon request of particular bureaus, dealing with matters of interest; (3) greater amount of advice, due to growth among officials of the department in the practice of conferring informally with the lawyers. The volume of usual activities for the same period increased.

New duties were chiefly in connection with the United States cotton futures Act of August 18, 1914 (38 Stat., 693). Appropriate forms were prepared for the establishment and promulgation of the nine grades of official cotton standards; aid was given in drafting regulations for the administration of the act, including a scheme for hearing and determining disputes as to grade, quality, or length of staple, of cotton tendered under a future contract made in accordance with section 5 thereof; forms were also drawn for pleadings, conclusions of examiners, and findings of the Secretary, for use in such disputes.

This office participated with the Office of Markets and Rural Organization in the consideration of 703 disputes under the act, involving 44,773 bales of cotton, referred to the Secretary. Six hundred and eighty-five of the disputes, involving 44,290 bales and assessed costs aggregating \$15,460.70, were finally disposed of. The remaining 18 disputes were pending at the close of the year, awaiting information requested from the parties or correction of errors in papers filed.

In order to familiarize the public with the meaning of various provisions of the act and to facilitate its operation, assistance was rendered in preparing upward of 75 opinions, distributed through



the Office of Markets and Rural Organization. For a like purpose the Solicitor prepared an address on the statute, which was delivered before the Alabama State Bar Association, July 10, 1915, and published in Service and Regulatory Announcements No. 5 of the Office of Markets and Rural Organization, issued August 11, 1915.

After extended study of the antitrust laws, advice and suggestions were given the Office of Markets and Rural Organization relative to the work of helping farmers and others in the formation and operation of cooperative associations.

The legal features of various systems of rural credits were investigated, and information furnished the Office of Markets and Rural Organization, with a view to the establishment of those systems best adapted to the needs of the United States.

Much time was devoted to constitutional questions involved in determining how far Congress may act in the establishment of standards for cotton, grain, foods, drugs, and other commodities, and the extent of the power of Congress to enact a statute providing for the establishment of privately owned warehouses operating under licenses from the Federal Government.

Prior to 1915 each written opinion of this office customarily went only to the bureau or official asking to be advised. Now, unless there be affirmative reason to the contrary, whenever such an opinion is of general application or deals with a subject of general concern, it is furnished to every branch of the department.

The usefulness of the office has been greatly increased by personal conferences and contact with officials charged with the exercise of the administrative and regulatory functions of the department. In past years advice was more usually sought in formal memoranda or letters. In the nature of things that method did not conduce to thorough understanding of the viewpoint or of the practical difficulties and necessities of the officials requesting opinions. Nor did the previous system tend to develop the sympathetic cooperation which ought to exist between attorney and client, which, in essence, is the real relation obtaining between lawyers in this office and the other officials of the department.

An important and time-consuming item, much in excess of previous years, was the review, from the legal standpoint, of manuscripts for publication prepared in various other subdivisions of the department. To a similar extent and for like purpose many letters prepared in those subdivisions were examined and changes recommended when necessary.

Eleven hundred and fifty-nine written opinions, including 611 for the Forest Service, were rendered to the Secretary, chiefs of bureaus, United States attorneys, and employees, or persons affected by the work, of the department, on law questions. No account was kept of the number of the many informal opinions rendered.

More than 100 opinions were prepared and circulated, either as decisions of the department or as answers to letters received, construing and explaining, for the information of the public, the provisions of the net-weight amendment of March 3, 1913 (37 Stat., 732), to section 8 of the food and drugs act.

Aid was given to the Bureau of Animal Industry in framing regulations governing the payment of claims arising out of the eradication of the foot-and-mouth disease, to the Federal Horticultural Board

in framing regulations governing importation of cotton, and to the advisory committee on finance and business methods in completing the revision of the fiscal regulations, in amending the administrative regulations, and in drafting property regulations; also to the administrative officers of the department generally in revising and preparing proposed amendments to sundry other regulations, including those relating to the National Forests, Federal bird reserves, food and drugs, meat inspection, migratory birds, animal quarantines, and plant quarantines. The office participated in a conference with Treasury officials in New York on, and assisted in arranging the details of, the revision of that part of the customs regulations affecting the work of this department.

Many documents of various kinds, including statements of issues, briefs, and memoranda on legal matters, were prepared, on behalf of the officials of this department, for submission to the Attorney General, the Secretary of the Interior, the Comptroller of the Treasury, and officers of other departments. Among the questions were whether the State of Tennessee had the power to make grants of lands in the former Cherokee Indian country in that State, and whether this department is authorized under the Weeks forestry law to purchase lands, the titles to which had their source in those grants; whether timber may be taken free of charge from areas in reclamation withdrawals in National Forests by private parties cooperating with the Reclamation Service in dam construction within the withdrawals, and whether receipts by the Forest Service from sales of timber from such withdrawals should be deposited in the reclamation fund; whether section 4 of the act of February 1, 1905 (33 Stat., 628), authorizes the use of rights of way thereby granted for the development and utilization of hydroelectric power; whether any part of the moneys appropriated by the Weeks forestry law is available for expenses in the city of Washington of employees of the department engaged in supervision and general administration of the acquisition of lands under that law; whether appropriations for extermination of noxious animals on National Forests and on the public domain are available for similar purposes on military and Indian reservations; whether, in determining the character of land in a National Forest subject to entry under the mineral laws, it is not necessary to consider the value of the timber on the land as against the value of the minerals therein; whether an employee suspended pending an investigation of his official conduct may be paid compensation during the period of his suspension, while the investigation is in progress, and whether he may be paid compensation for the period of his suspension, if, upon the completion of the investigation, his restoration to duty is ordered as of the date of his suspension.

Law work for the Forest Service during the year included handling the following cases and other business:

Claims to lands.....	724	Trespasses—Continued.	
Hearings attended.....	99	Fire .....	93
Depositions taken.....	41	Occupancy.....	50
Briefs prepared and filed..	83	General litigation.....	23
Oral arguments.....	9	Written opinions.....	611
Trespasses:		Contracts.....	1, 806
Grazing .....	141	Proclamations.....	25
Timber .....	74		

The following summary shows what the office did in the fiscal year 1915 in connection with the acquisition of lands under the Weeks forestry law:

Character of work.	Tracts.	Acreage.
Purchases authorized by the National Forest Reservation Commission.....	149	282,900
Agreements of purchase prepared.....	109	195,276
Titles in process of examination at the beginning of the year.....	102	112,165
Examinations of titles completed and reported to the Department of Justice:		
Purchases recommended.....	50	156,842.96
Condemnations recommended.....	182	192,292.72
Examinations of titles completed but not reported to the Department of Justice.....	51	52,942
Titles in process of examination at the end of the year.....	49	293,761
Completion of direct purchases after approval of titles by the Attorney General.....	72	92,666.37
Completion of purchases of lands acquired through condemnation.....	27	64,854.09

Four meetings of the National Forest Reservation Commission were attended.

In addition to the 1,806 contracts prepared for the Forest Service and the 109 purchase agreements under the Weeks law, 201 contracts, 288 leases, 14 bonds, 215 renewals, and 37 notices of termination were drafted for the several bureaus, divisions, and offices of the department, making a total of 2,670 documents of these classes.

Violations of statutes intrusted to the department for enforcement upon which reports were made and prosecutions recommended to the Attorney General, or upon which settlements were effected without litigation, and the amounts of fines and recoveries in cases terminated and reported to this office during the year were as follows:

Law invoked.	Violations.	Fines and recoveries.	Law invoked.	Violations.	Fines and recoveries.
Laws for the protection of National Forests.....	381	<sup>1</sup> \$17,552.02	Migratory bird law.....	38	\$55.00
Food and drugs act.....	875	11,316.00	Insecticide act.....	51	1,610.00
Twenty-eight hour law.....	582	80,300.00	Plant quarantine act.....	4	415.00
Animal quarantine acts.....	189	17,580.00	Virus act.....	12	315.00
Meat-inspection law.....	155	3,990.00	Miscellaneous.....	29	270.00
Lacey Act.....	30	1,093.00	Total.....	2,346	134,496.02

<sup>1</sup> \$3,501.32 outstanding.

In addition, 387 decrees of condemnation and forfeiture were entered under the food and drugs act and 8 under the insecticide act.

Fewer violations of the 28-hour law and the animal quarantine laws were reported than during the fiscal year 1914, due largely to an outbreak of foot-and-mouth disease among live stock, which curtailed shipments and diminished the time inspectors of the department could devote to collecting evidence of violations of these laws. However, there were more trials in the fiscal year 1915, and penalties and fines aggregating \$97,880 were collected in 761 cases, as against \$53,355 the preceding year in 425 cases.

There was an increase in the number of violations of the food and drugs act reported during the year, due primarily to the collection and examination by the Bureau of Chemistry of a great many samples of drugs in accordance with a plan outlined during the previous year for the purpose of enforcing the Sherley amendment (37 Stat., 416).



The number of violations reported of each of the other regulatory acts with which this department is concerned varied somewhat from the number reported during the previous year, but in the aggregate was practically the same.

This office examined all the evidence gathered by department inspectors and communicated to it under these several regulatory statutes, and advised that prosecutions could not be maintained in a considerable number of cases.

Reports coming to the office from various sources which disclosed apparent violations of the postal laws and regulations, as hertofore, were referred to the Postmaster General for investigation.

Many memoranda on legal questions were furnished in cases reported to the Department of Justice for prosecution. Among the important cases in which this office assisted in the preparation of briefs were the *Pittsburgh Melting Co. v. Baltimore & Ohio Railroad Co.* and *George E. Totten*, inspector, still pending; *Chicago, Milwaukee & St. Paul R. R. Co. v. United States* (218 Fed., 288); five cases in the district of Utah against the *Utah Power & Light Co.* and three other companies (unreported); *United States v. Colorado Power Co.*, still pending; *Boise Lumber Co. v. Pacific & Idaho Northern Railroad Co.* and the *Oregon Short Line R. R. Co.*, *United States*, intervenor (33 I. C. C., 109); and *United States v. Hodges* (218 Fed., 87).

The practice of reporting to the Attorney General cases under the food and drugs act, animal quarantine acts, plant quarantine act, and insecticide act, in the form of proposed informations, already completely drafted, for use by the United States attorneys, was continued and extended during the year to cases under the Lacey act and the virus act. It has been demonstrated that this plan is of great assistance in quickly disposing of prosecutions.

Further to facilitate prosecutions under the food and drugs act, a representative of the office was detailed to confer with United States attorneys. Visits were made to nearly all districts where food and drugs cases were pending. The conferences resulted in the termination during the year of a number more than 23 per cent in excess of the number closed during the fiscal year 1914. Except in two districts, practically all such cases not terminated by the close of the fiscal year 1915 were reported during that year.

Thirty-nine cases involving questions of irregularity or misconduct by employees in the performance of their official duties were reviewed. In each the facts were investigated. In 22, formal charges were prepared; after the employees concerned had had full opportunity to reply, the charges, the answers, and the evidence received consideration, and the matters were reported to the Secretary for his decision.

Seven applications for letters patent on inventions of employees of the department for dedication to the public were prepared and filed.

Twenty claims for balances due estates of employees of the department who died intestate were examined, the necessary papers prepared for their payment, and advice furnished administrative officers of the department relating to the same.

At the instance of committees of Congress, or upon instructions of the Secretary, aid was given in drafting or in drawing the de-

partment's reports on bills dealing, among other subjects, with warehousing, grain standards, cotton standards, protection of game and fish on lands acquired under the Weeks forestry law, and terminal inspection, by any State establishing and maintaining a system of such inspection, of plants and plant products transmitted through the mails. A clause authorizing such terminal inspection was incorporated in the agricultural appropriation act for the fiscal year 1916.

In cooperation with the chairman of the Federal Horticultural Board, a model was prepared for a State statute to prevent the introduction and dissemination of insect pests and diseases injurious to plants and plant products. This is intended for use in an effort to procure uniform State laws, in harmony with the Federal law, on the subject.

An article was prepared containing a brief statutory history of the Department of Agriculture, with a discussion of the constitutionality of the organic act creating the department and of the various acts of Congress upon which the activities of the department are based. This has been accepted for publication by a legal periodical having a large circulation among lawyers, with consent that the department may republish all or any part of it.

One law clerk was added during the year. Notwithstanding the increase in volume of business, the work was current at the end of the year.

Tabulated statements showing, in detail, facts and status of the principal prosecutions originating in the department, in which United States attorneys have commenced proceedings, and of the claims and other cases affecting the administration of the National Forests in which this office is concerned, are submitted for your information. It is recommended that these be filed for reference.

Somewhat detailed statements of the principal activities of the office, without reiteration of what has been fairly covered by the foregoing summary, follow.

## ADMINISTRATION OF ACTS OF CONGRESS.

### STATUTES RELATING TO THE NATIONAL FORESTS.

#### LAND CLAIMS.

Seven hundred and twenty-four claims to upward of 200,000 acres of land in National Forests, under the homestead, timber and stone, mineral, lien and railroad selection, and other general and special land laws of the United States, were handled.

Three hundred and sixty decisions were rendered, including those of registers and receivers and the Commissioner of the General Land Office, subject, respectively, to review by the Commissioner and the Secretary of the Interior. The registers and receivers decided 44 cases for and 37 against the Government. The Commissioner decided 131 cases for and 91 against the Government. The Secretary decided 39 cases for and 18 against the Government. Of the 360 cases, 237 were closed during the year, 108 by decisions for and 109 against the Government, 10 by voluntary withdrawal of Forest Service protests, 5 by eliminations of the lands from the forests, 4 by relinquishments filed by claimants, and 1, a mineral case, by decision in part favorable to the Government. As a result of the

108 decisions for the Government, approximately 18,000 acres of land, supporting a stand of approximately 220,000,000 feet of merchantable timber, worth approximately \$700,000, were retained in the National Forests.

The remaining 364 cases received attention, varying in degree with their progress in the Forest Service and in the Interior Department.

Hearings were attended in 99 cases. Oral arguments were made before the Secretary of the Interior in 9 cases. Briefs were filed in 83 cases. Depositions were taken in 41 cases. In 3 cases before the Secretary of the Interior motions for rehearing, accompanied by supporting briefs, were filed. Appeals to the Secretary of the Interior, supported by briefs in each case, were prosecuted from 26 adverse decisions of the Commissioner.

The assistants to the Solicitor in the field examined and passed upon the evidence in many cases, preparatory to reports to the Commissioner of the General Land Office recommending adverse proceedings. They also were in frequent conferences with executive officers of the Forest Service on questions arising out of claims cases.

Revision of the joint order of the Secretary of the Interior and the Secretary of Agriculture of November 25, 1910 (39 L. D., 374), prescribing the procedure for cooperation between the two departments in the handling of claims cases, was practically completed during the year. This will eliminate all duplication of work in the two departments in these cases. As soon as the revision becomes effective, early in the succeeding year, the assistants to the Solicitor of the Department of Agriculture will be in exclusive charge of hearings directed by the Department of the Interior in cases involving claims to lands within National Forests, and the expense of attendance of special agents of the General Land Office at these hearings will be saved.

DECISIONS OF THE SECRETARY OF THE INTERIOR.—Of exceptional interest and importance to this department was the decision of the Secretary of the Interior in *United States v. Svan Hoglund* (43 L. D., 540), involving a homestead entry for lands within a National Forest. This arose from a motion of this office for reconsideration of a prior decision which had ordered that Hoglund be allowed to submit commutation proof. It was urged in behalf of Hoglund that his entry was confirmed by the act of March 3, 1891 (26 Stat., 1095), as construed in *Jacob A. Harris* (40 L. D., 300). In the *Harris* case, as stated in the report of this office for 1914, the Department of the Interior held that proceedings can not be prosecuted against a homestead claim unless they were directed by the Commissioner of the General Land Office within two years after issuance of receiver's final receipt. The proceedings in the *Hoglund* case were not directed within two years immediately succeeding the issuance of final receipt; but the Secretary found that Hoglund had not complied with the homestead law, in the matter of residence and cultivation, between the date of his entry and the date of the withdrawal of the lands for forest purposes, and therefore held that Hoglund could not invoke the exception in the withdrawal proclamation in favor of valid claims existing at the date of the withdrawal; that the act of 1891 had no application to the case; and that the issuance to him of final receipt was a nullity.

Immediately upon rendition of this decision, Hoglund applied to the Supreme Court of the District of Columbia for a writ of man-



damus to compel the Secretary of the Interior to recall and revoke his decision, to reinstate the entry, and to issue patent. A rule to show cause was issued, and this office assisted in the preparation of the Secretary's return. The matter was pending argument at the close of the year.

As a result of the ruling of the Secretary of the Interior in the Høglund case, four other cases of similar nature were subsequently decided in favor of the Government.

In Ada B. Millican, upon the appeal of this office, the Secretary of the Interior overruled the Commissioner of the General Land Office and held that where a 40-acre subdivision of land is chiefly valuable because of a spring which it contains, and not for its timber, it can not be appropriated under the timber and stone law of June 3, 1878 (20 Stat., 89), and that each 40-acre subdivision applied for must be sold at not less than the minimum price of \$2.50 per acre, notwithstanding the purchase price of the entire tract would be sufficient to make the average price per acre more than the specified minimum.

#### TRESPASS.

Damages and fines recovered during the year for trespasses upon the National Forests were:

Class of trespass.	Damages.	Fines.
Grazing.....	\$4,617.09	\$260
Timber.....	9,127.59	25
Fire.....	2,088.44	890
General.....	233.90	310
Total.....	16,067.02	1,485

In addition, 45 cases of illegal occupancy of National Forest lands, principally involving the appropriation of lands for hydroelectric power development and transmission without permit, illegal inclosures, and claims of title adverse to the United States, were dealt with by the institution of injunction proceedings, settlement without recourse to the courts, or other means not including the assessment of damages or fines. Decrees for the United States were entered in 15 cases; decree passed for defendant in one case which is now pending on the Government's appeal; 2 cases were dismissed; 1 was settled by defendant's quitclaiming the land to the United States; and the remaining cases were pending in various stages in court at the close of the year.

From the financial standpoint, the most important trespass case handled during the year was that against the Great Northern Railway Co., C. W. Werdenhoff, and Winston Bros. Co. Suit was instituted against these defendants in the district of Montana to recover upward of \$232,000, the value of timber destroyed by fires started through the alleged negligence of Winston Bros. Co., subcontractor of Werdenhoff, who had contracted with the railway company to widen and clear a portion of its track.

#### GENERAL LITIGATION.

Twenty-three cases not referable to any of the above classes were handled. Among these were two suits for the recovery of damages for breaches of timber-sale contracts; one by the Northern Pacific

Railway Co. against a purchaser of National Forest timber to restrain him from cutting timber from the land which the company claims by virtue of an alleged selection, and one against a Forest Service special-use permittee to restrain him from occupying land which is alleged to be embraced in the plaintiff's mining claim. One case involving the falsification of accounts resulted in conviction and a fine of \$60. In a bribery case the grand jury returned no true bill. An indictment has been found and is pending in one forgery case. Four cases involve larceny of Government property. There were two cases involving personation of employees of the Forest Service, one resulting in conviction and sentence to 30 days in jail, and the other in a pending indictment. Three cases of destruction of Government property resulted in conviction and sentence to 60 days in jail in one, in an indictment in another, and in preparation for presentation to the grand jury of the third. One case of an assault upon a forest ranger resulted in the acquittal of the defendant. Another defendant was acquitted of the charge of killing a Government witness. Four appropriations of water for the Forest Service under State laws were pending in various stages at the close of the year.

#### COURT DECISIONS OF INTEREST.

In *Chicago, Milwaukee & St. Paul Railway Co. v. United States* (218 Fed., 288) the Circuit Court of Appeals for the Ninth Circuit affirmed the decision of the district court decreeing specific performance by the company of an agreement to execute a stipulation for the protection of the Coeur d'Alene National Forest and for the payment to the United States of \$68,489, the value of timber cut by the company in constructing its right of way across the forest.

Following the decision of the Circuit Court of Appeals for the Eighth Circuit in *United States v. Utah Power & Light Co.* (209 Fed., 554), the United States District Court for the District of Utah entered decrees restraining five hydroelectric power companies from further occupancy of national forest lands in Utah without permission from the Secretary of Agriculture.

In *Boise Lumber Co. v. Pacific & Idaho Northern Railroad Co. and Oregon Short Line Railroad Co.*, in which, at the request of this department, the Attorney General intervened in behalf of the Government, the Interstate Commerce Commission (33 I. C. C., 109) ordered a reduction of 2 cents per hundred pounds in the rate charged by the two companies for transportation of logs on their lines into Boise from territory embracing the Weiser National Forest. By this reduction it is expected that timber theretofore unmarketable on account of high freight rates will now be available for sale.

In *Cameron v. Bass*, a suit to enjoin a special-use permittee of this department from occupying certain lands within an alleged mining location, the court overruled plaintiff's motion to strike parts of defendant's answer setting up the cancellation of the location by the Secretary of the Interior, and held that, where the Interior Department rejects the application for a patent and annuls the location, it is proceeding fully within its powers.

*United States v. Hodges* (218 Fed., 87) involved the occupancy by defendant of land which had been reserved by the President for the

use of the Forest Service as an administrative site. Several applications of defendant for permits to occupy the land were denied, notwithstanding which he continued in possession, claiming want of authority in the President to reserve the land. The court held that defendant's occupancy was both a purpresture and a public nuisance, and decreed immediate abatement thereof, holding that, if there were any doubt of the power of the President generally to withdraw the lands, the act of June 25, 1910 (36 Stat., 847), although passed after the withdrawal, was sufficient to sustain it, upon the theory that the continued recognition of the withdrawal after the passage of that act by the departments of the Government concerned with the administration of the public domain as representatives of the President was in effect tantamount to a renewal of the withdrawal.

#### THE WEEKS FORESTRY LAW (36 STAT., 961).

There was marked increase in the results accomplished under the Weeks forestry law during 1915, as will appear by comparison of the tabulated statements in this report and the report for 1914. A larger number of titles were examined, more reports were submitted to the Department of Justice, and the acreage acquired was greater.

Following approval by the National Forest Reservation Commission of purchases in the "Boone Area," which includes parts of McDowell, Mitchell, Burke, and Caldwell Counties, N. C., the office perfected arrangements for handling the examination of titles therein during the coming year. Necessary data pertaining to State grants of the lands proposed to be acquired are now being copied from the records in the capitol at Raleigh.

From time to time during the year title attorneys have assisted United States attorneys in the preparation of their reports to the Attorney General upon titles referred to them for opinions and in the preparation and conduct of condemnation proceedings.

Appended is a summary in terms of acres of operations under the Weeks law from the beginning to June 30, 1915.

State and area.	Purchases authorized.	Purchases completed.	Reports in Department of Justice.	
			For opinion.	For condemnation.
Georgia:				
Georgia.....	61,652	131,002.89	146.30	23,700.68
Savannah.....	<sup>2</sup> 34,752	4,171.70	.....	16,246.07
New Hampshire:				
White Mountain.....	256,467	106,012.67	.....	70,618.74
North Carolina:				
Boone.....	36,386	.....	.....	.....
Mount Mitchell.....	75,333	28,696.49	434.02	2,303.87
Nantahala.....	39,003	28,402.90	213.56	2,166.89
Pisgah.....	86,700	.....	.....	.....
Savannah.....	39,452	12,364.85	840.07	15,019.02
South Carolina:				
Savannah.....	25,001	.....	.....	15,988.10
Tennessee:				
Cherokee.....	<sup>3</sup> 135,686	45,121.44	126.79	6,302.87
Smoky Mountain.....	59,213	.....	<sup>3</sup> 61,350.41	.....
White Top.....	84,387	39,167.82	.....	10,098.53
Unaka.....	19,756	.....	.....	11,941.03

<sup>1</sup> 1874 acres reported in this area in last year's report now carried in the Savannah (Ga.) area.

<sup>2</sup> Acreage reported last year reduced under actual survey.

<sup>3</sup> The acreage was reduced subsequent to examination of titles.



State and area.	Purchases authorized.	Purchases completed.	Reports in Department of Justice.	
			For opinion.	For condemnation.
Virginia:				
Massanutten.....	62,793	<sup>1</sup> 3,683.86	24,718.84	8,835.09
Natural Bridge.....	79,268	25,241.59	2,788.40	.....
Potomac.....	62,334	22,552.65	14,927.61	4,953.42
Shenandoah <sup>2</sup> .....	<sup>3</sup> 123,971	.....	105,124.13	7,776.16
West Virginia:				
Monongahela.....	52,610	.....	.....	.....
Potomac.....	15,995	1,913.06	3,722.96	678.87
	1,350,759	348,291.92	214,393.49	196,629.39

<sup>1</sup> By typographical error, last year's report showed 11,787 instead of 1,787 acres purchased.

<sup>2</sup> Includes Shenandoah area in West Virginia.

<sup>3</sup> Acreage reported last year reduced under actual survey.

#### THE FOOD AND DRUGS ACT (34 STAT., 768).

Seven hundred and sixty-seven cases were transmitted to the Department of Justice, in 276 of which criminal proceedings and in 491 of which seizures were recommended. The 276 criminal cases embraced 335 alleged violations of the food and drugs act.

At the close of the fiscal year 1914, 626 cases were pending, of which 465 were criminal prosecutions and 161 were seizures.

Four hundred and ninety-two cases pending at the close of the fiscal year 1914 and 466 reported during the fiscal year 1915, in all 958, were terminated in 1915. Of those terminated 501 were criminal and 457 were civil. Three hundred and sixty-eight of the 501 criminal cases terminated were pending at the close of the fiscal year 1914 and represent 426 violations.

In 220 of the 501 criminal cases fines were imposed; sentence was suspended in 2; in 3, the informations were placed on file; in 3, no fines were imposed; in 3, the judgments of conviction of the lower court were affirmed; in 1, the judgment of conviction of the lower court was reversed; in 1, the information was quashed; in 2, demurrers to the informations were sustained; in 1, there was acquittal; in 98, there were nolle prosequies; and 167 were withdrawn, dismissed, or barred by the statute of limitations. In a majority of the cases in which fines were imposed, pleas of guilty, nolo contendere, or non vult were entered. In 5, pleas of not guilty were entered, and the defendants were convicted after trial.

In the criminal cases in which convictions were obtained, the fines were as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
5	\$1	\$5	4	\$30	\$120	4	\$150	600
8	5	40	1	35	35	7	200	1,400
33	10	330	5	40	200	1	1,250	250
9	15	135	38	50	1,900	2	2,300	600
1	16	16	6	75	450	1	3,400	400
11	20	220	1	80	80			
54	25	1,350	27	100	2,700	<sup>4</sup> 218	.....	10,831

<sup>1</sup> In this case there were four counts to the information.

<sup>2</sup> In one of these cases three informations were filed, and in the other one prior conviction was alleged.

<sup>3</sup> In this case there were two counts to the information.

<sup>4</sup> This number represents 220 cases reported to the Department of Justice, some of which were consolidated by the United States attorneys for trial.

In addition to the fines imposed, costs were generally assessed.

Of the 457 civil cases terminated during the year, decrees of condemnation and forfeiture were entered in 387<sup>1</sup>; in 13, the proceedings were terminated by release of the products upon stipulations of the parties or by order of the court without condemnation; in 20, the libels were dismissed or the proceedings discontinued or dropped with the consent of the Government; in 36, the packages were broken or disposed of before seizure could be made; and in 1, exceptions to the libel were sustained. In the 387 cases in which decrees of condemnation and forfeiture were entered, the goods were destroyed in 209; released on bond in 140; sold in 30; partly destroyed and partly released in 2; partly destroyed and partly sold in 2; distributed to charitable institutions in 2; ordered released or destroyed in 2.

At the close of the year 435 cases were pending, of which 233 were criminal prosecutions and 202 were seizures.

In addition to the cases reported by this department to the Department of Justice, the food and drugs officials of the various States and of the District of Columbia, collaborating with the department in the enforcement of the act, reported 53 cases to United States attorneys for action. Of these, 49 were criminal cases and four were seizures. In all but one of the criminal cases there were convictions, and in the one in which there was no conviction the collateral deposited by the defendant was forfeited by reason of his nonappearance for trial. In two of the seizure cases consent decrees were entered and the products released on bond, and in the other two, default decrees of condemnation were entered and the products ordered destroyed. The fines in the criminal cases were as follows:

Number of cases.	Amount of fines.	Total.
12	\$5	\$60
31	10	310
4	15	60
1	25	25
1	30	30
49	.....	485

Six hundred and ninety notices of judgment were prepared.

#### CASES OF INTEREST.

In *Glaser, Kohn & Co. v. United States* (Circular No. 84, Office of the Solicitor; 224 Fed., 84) the United States Circuit Court of Appeals for the Seventh Circuit, construing section 9 of the act, held that a guaranty, in the form of a letter, expressed to be good until revoked on all articles sold, continued to be effective until revoked, and that the guarantor was liable to punishment for violation of the act, notwithstanding his sale and delivery of the goods were consummated wholly within the State.

In *United States v. 4 boxes of Mulford's Wintergreens* (N. J. 2440) the article was alleged to be adulterated in that it was confectionery and contained talc. The claimants contended that the article was a drug, and therefore not subject to the provisions of the

<sup>1</sup> Two of these cases were won on appeal by the Government to the Circuit Court of Appeals.

act relating to confectionery. The jury found that the article was confectionery, and that it was adulterated.

In *United States v. R. C. Boeckel & Co. et al.* (N. J. 3871; Circular No. 82, Office of the Solicitor; 221 Fed., 885) the Circuit Court of Appeals for the First Circuit held that confectionery is adulterated if it contain talc in any quantity, however small.

In *United States v. The American Laboratories* (N. J. 3962; 222 Fed., 104) a drug labeled "Bad-Em-Salz" was held to be misbranded within the meaning of the act and the amendment of August 23, 1912 (37 Stat., 416), because statements on the label regarding the therapeutic or curative effects of the article, including the name "Bad-Em-Salz," were false, misleading, and fraudulent. A motion to quash that part of the information charging violation of the amendment of August 23, 1912, based on the ground that the amendment is unconstitutional, because it attempts to establish criteria in matters of opinion which are incapable of judicial ascertainment and decision, and is not a regulation of commerce; that it attempts an unreasonable restriction of the citizen's right to engage in commerce; and, in effect, deprives persons of property without due process of law, was overruled.

In *United States v. Rigney & Co.* (220 Fed., 734) sirup in bottles and cans shipped in boxes labeled "24 quarts com." and "12 half gallons com." was held to be misbranded because the bottles and cans contained less than standard quarts and half gallons, notwithstanding the trade might understand that the labels meant "commercial" quarts and half gallons.

Among other cases of interest were the following:

- United States v. 60 Bbls. of Wine*, Notice of Judgment No. 3529.
- United States v. David Lowenthal*, Notice of Judgment No. 3573.
- United States v. 267 Boxes Macaroni*, Notice of Judgment No. 3799.

#### THE MEAT-INSPECTION LAW (34 STAT., 674).

One hundred and fifty-five cases were reported to the Attorney General.

At the close of the fiscal year 1914, 96 cases were pending.

Of the cases reported during the fiscal year 1915, 98, and of those pending at the close of the fiscal year 1914, 88, in all 186, were terminated during 1915. One hundred and thirty-five resulted in conviction, 31 were dismissed, in 11, grand juries failed to indict, and in 9, verdicts were rendered for the defendants.

Three sentences of imprisonment were imposed, one of 30 days and two of 10 days each, in addition to fines of \$50 in each case. In six cases sentences were suspended upon payment of costs.

Fines aggregating \$3,990 were imposed in 130 cases, as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
8	\$5	\$40	2 44	\$25	2 \$1,000	1	\$200	\$200
1 32	10	1 300	12	50	600	1	1,000	1,000
8	15	120	3 14	100	3 400			
9	20	180	1	150	150	130	.....	3,990

<sup>1</sup> 2 cases were consolidated with 2 others and fines of \$10 imposed in each instance.

<sup>2</sup> 4 cases were consolidated with others and fines of \$25 imposed in each instance.

<sup>3</sup> 11 cases against 1 defendant were consolidated and a fine of \$100 imposed.

At the close of the year 65 cases were pending.



## CASES OF INTEREST.

In *Armour & Co. v. United States* (222 Fed., 233; Circular No. 83, Office of the Solicitor), the Circuit Court of Appeals for the Third Circuit held that the use of the meat-inspection label on wrappers, inclosing hams boiled without inspection, was the use of a label without proper authority within the meaning of the meat-inspection act, notwithstanding the hams had been previously inspected and passed, and so marked, in accordance with the provisions of the statute.

In *United States v. Lewis et al.* (235 U. S., 282), the Supreme Court held that the clause of the meat-inspection act prohibiting the alteration, defacement, or destruction of marks, stamps, or other identification devices provided for in the act or the regulations thereunder, on articles subject to the act, applies to any person, firm, or corporation, whether engaged in the meat industry or not.

## THE TWENTY-EGHT HOUR LAW (34 STAT., 607).

Five hundred and eighty-two cases were reported to the Attorney General.

At the close of the fiscal year 1914, 1,779 cases were pending.

Of the cases reported during the fiscal year 1915, 69; and of those pending at the close of the fiscal year 1914, 1,175, in all, 1,244, were terminated during 1915.

Penalties aggregating \$80,300 were recovered in 597 cases. Six hundred and forty cases were dismissed and 7 were determined adversely to the Government.

The following is a detailed list of the number of cases prosecuted and amounts of penalties assessed:

Number of cases.	Amount of penalty.	Total.	Number of cases.	Amount of penalty.	Total.	Number of cases.	Amount of penalty.	Total.
1	\$25	\$25	13	\$250	\$3,250	64	\$800	\$51,200
1424	100	142,000	222	300	66,600	74	850	62,800
13	125	1,625	12	400	4,800	84	900	75,600
23	150	3,450	10	500	5,000			
64	200	12,800	3	700	2,100	597	.....	80,300

<sup>1</sup> 6 cases were consolidated into 2 cases and a single penalty of \$100 imposed in each.

<sup>2</sup> 18 penalties of \$300 each were imposed, 4 cases being consolidated with other cases.

<sup>3</sup> 10 penalties of \$400 each were imposed, 2 cases being consolidated with other cases.

<sup>4</sup> 9 penalties were imposed, 1 case being consolidated with another case.

<sup>5</sup> 3 cases were consolidated for trial and a penalty of \$700 imposed in the 3.

<sup>6</sup> 4 cases were consolidated for trial and a penalty of \$800 imposed in the 4.

<sup>7</sup> 4 cases were consolidated for trial and a penalty of \$850 imposed in the 4.

<sup>8</sup> 4 cases were consolidated for trial and a penalty of \$900 imposed in the 4.

Eleven hundred and seventeen cases were pending at the close of the year.

## DECISIONS OF THE COURTS.

Among the cases of interest decided during the year were:

*United States v. Oregon Short Line R. R. Co.* (218 Fed., 868) and *United States v. Delaware, Lackawanna & Western R. R. Co.* (220 Fed., 944).

**ACTS REGULATING THE INTERSTATE MOVEMENT OF LIVE STOCK FROM QUARANTINED DISTRICTS, PROHIBITING THE INTERSTATE MOVEMENT OF DISEASED LIVE STOCK, AND PROHIBITING THE IMPORTATION OF DISEASED LIVE STOCK (23 STAT., 31; 26 STAT., 414; 32 STAT., 791; 33 STAT., 1264).**

Six cases involving violations of the act of May 29, 1884 (23 Stat., 31), were reported to the Attorney General. At the close of the fiscal year 1914 five cases were pending. Five cases reported during 1915, and three pending at the close of 1914, in all eight, were terminated during 1915. Two of the cases terminated favorably to the Government and a fine of \$100 was imposed in each. In two cases grand juries failed to indict, and four cases were dismissed. At the close of 1915 three cases were pending.

One case under the act of August 30, 1890 (26 Stat., 414), was reported to the Attorney General, which was pending at the close of the year.

Twenty-five cases were reported to the Attorney General under the act of February 2, 1903 (32 Stat., 791). In three of these the defendants pleaded guilty and were each fined \$100. In five cases grand juries failed to indict, while prosecution in two cases was abandoned. At the close of the year 15 cases were pending.

One hundred and fifty-eight violations of the act of March 3, 1905 (33 Stat., 1264), were reported to the Attorney General. At the close of the fiscal year 1914, 211 cases were pending. One hundred and one of the cases reported during 1915 and 152 pending at the close of 1914, in all 253, were terminated during 1915. One hundred and sixty-one cases resulted in convictions; in 5, grand juries failed to indict; 9 resulted adversely to the Government; and 78 were dismissed. In two cases the defendants were discharged upon payment of costs, after pleas of guilty. Fines aggregating \$17,080 were imposed in 159 cases. At the close of 1915, 116 cases were pending.

The fines imposed in cases under the animal quarantine laws were:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
1	\$5	\$5	5	\$250	\$1,250
1	10	10	1	300	300
1	15	15			
1146	100	114,200	104	.....	17,580
9	200	1,800			

<sup>1</sup> Four cases were consolidated with others and a penalty of \$100 assessed in each instance.

A great number of orders of the Secretary of Agriculture establishing or changing quarantines under section 1 of the act of 1905 were examined as to their legal form and sufficiency, the major portion resulting from an outbreak of foot-and-mouth disease. A number of sets of new regulations were likewise examined.

During the year the Supreme Court of the United States, in *United States v. Nixon et al.* (235 U. S., 231), decided that the act of March 3, 1905 (33 Stat., 1264), as amended March 4, 1913 (37 Stat., 828, 831), applies to receivers of railroad companies.

**THE VIRUS ACT (37 STAT., 832).**

Twelve apparent violations of the act of March 4, 1913 (37 Stat., 832), governing the preparation, shipment, and importation of viruses, serums, toxins, and analogous products, intended for use in the

treatment of domestic animals, were reported to the Attorney General. At the close of the fiscal year 1914 two cases were pending. The 12 reported during 1915 and 1 pending at the close of 1914, in all 13, were terminated during 1915. In all the cases the defendants pleaded guilty and were fined.

The fines imposed were:

Number of cases.	Amount of fine.	Total.
1	\$15	\$15
2	25	50
1	50	50
9	100	200
13	-----	315

<sup>1</sup> A fine of \$100 was imposed in eight cases which were consolidated.

One case was pending at the close of the year.

#### THE INSECTICIDE ACT (36 STAT., 331).

Fifty-one cases were reported to the Attorney General, in 45 of which criminal proceedings and in 6 seizures were recommended. At the close of the fiscal year 1914, 101 cases were pending, of which 97 were criminal prosecutions and 4 were seizures. Fifty-three cases pending at the close of the year 1914, and 25 reported during the year 1915, in all 78, were terminated in 1915. Of the cases terminated, 70 were criminal and 8 civil. In the 70 criminal cases, fines were imposed in 57; sentences were suspended in 6; in 1 a demurrer to the information was sustained; and 6 were withdrawn or dismissed. In 52, pleas of guilty and in 11 pleas of *nolle contendere* or *non vult* were entered.

In the criminal cases in which convictions were obtained the fines were as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
3	\$5	\$15	9	\$50	\$450
17	10	170	4	100	400
1	15	15			
3	20	60	57	-----	1,610
20	25	500			

Costs were assessed in a considerable number of cases in which convictions were obtained. Decrees of condemnation and forfeiture were entered in the 8 civil cases. At the close of the year, 74 cases were pending, of which 71 were criminal prosecutions and 3 seizures. During the year 65 notices of judgment were prepared.

#### THE PLANT-QUARANTINE ACT (37 STAT., 315).

Four violations were reported to the Attorney General; 15 were pending at the close of the preceding year. Of the 19 cases, 10 have been closed. Fines amounting to \$415 were assessed. Nine cases were pending in various stages of prosecution at the close of the year.



A number of proposed orders of the Secretary of Agriculture to establish, and of regulations to enforce, quarantines under the law were examined as to their legal form and sufficiency.

#### THE LACEY ACT (35 STAT., 1137).

Thirty cases were reported to the Attorney General for prosecution. At the close of the year 1914, 83 cases were pending. Of the cases reported during the year 1915, 17, and of those pending at the close of the year 1914, 59, in all 76, were terminated in 1915; 45 resulted in convictions; 29 were dismissed or nolle prosequis were entered; and in 2 grand juries failed to indict. Thirty-seven cases were pending at the close of the year.

In the cases in which convictions were obtained, fines were as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
1	\$1.00	\$1	1	\$40	\$40
1	2.00	2	5	50	250
1	5.00	5	1	100	100
16	10.00	160	1	150	150
2	12.50	25			
3	20.00	60	44	-----	1,093
12	25.00	300			

In addition to the fines, defendants were compelled to pay substantial costs.

#### PROTECTION OF BIRD RESERVES LAW (35 STAT., 1104).

There were no prosecutions under this statute during the year.

#### THE MIGRATORY-BIRD LAW (37 STAT., 847).

Thirty-eight cases were reported to the Department of Justice for prosecution. Two cases were pending at the close of the preceding year. A total of \$55 in fines was assessed; in one case \$10, in another \$20, and in a third \$25. Grand juries refused to indict in 6; the statute was held unconstitutional in 4; and 2 were dismissed without action. Twenty-five cases were pending at the close of the year.

The Government's motion for rehearing in *United States v. Shauver* (214 Fed., 154) was overruled and an appeal is now pending in the Supreme Court.

Numerous letters were written replying to requests from various sections of the country for advice as to the interpretation of the regulations under the law.

#### MARKETS AND RURAL ORGANIZATION.

A new section was organized in this office September 1, 1914, following the enactment of the United States cotton futures Act of August 18, 1914 (38 Stat., 693). To it is referred all the legal work incident to the enforcement of that act and to the activities of the department in connection with questions of the distribution of farm products and the problems of rural life.

In cooperation with the Office of Markets and Rural Organization, regulations for the administration of the cotton futures act were pre-

pared. A public hearing held in Washington on these, and on the regulations of the Treasury Department under this act, was attended. Assistance was also given in the preparation of amendments to the regulations and in the draft of the Secretary's certificate promulgating official cotton standards for white cotton. Forms made necessary by the various provisions of the act were prepared. Numerous letters were prepared or reviewed in answer to questions propounded by persons whose business is affected by the act. Personal conferences were had at New York and New Orleans with members of the cotton exchanges in those cities in regard to the administration of the act. The rules of these exchanges and rules of the Carolina mills and the New England terms governing the purchase and sale of cotton were carefully examined and criticized from the standpoint of the act.

Near the close of the fiscal year two suits were filed in the United States District Court for the Southern District of New York in which the constitutionality of the cotton futures act is drawn in question.

Several drafts of proposed State laws providing for the organization of cooperative associations, submitted to the department for comment and suggestions, were studied and advice given in reference thereto. The incorporation laws of a large number of States, affecting banking and building and loan associations, were extensively investigated, in order to ascertain whether or not under these laws farmers' cooperative banks and other cooperative organizations might be created. A digest was prepared of the statutes and decisions of the courts of California bearing on cooperative associations, monopolies, and restraints of trade. With a view to advising the Office of Markets and Rural Organization, the advertising matter and contracts of certain companies operating farmers' loan schemes were reviewed. At the request of Members of Congress, examinations of, and suggestions with reference to, proposed legislation in furtherance of emergency loans on cotton were made.

#### GENERAL STATUTES.

At the close of the previous fiscal year there were pending 4 cases of violations of the general criminal laws of the United States reported to the Attorney General. During the present year 29 such cases were reported to the Attorney General. Of the cases reported this year, together with those coming over from previous years, 17 were disposed of. Nine of these were abandoned for lack of sufficient evidence; in 3, grand juries refused to indict; in 1, the defendant was fined \$200; in 1, the defendant was fined \$10 and costs upon a plea of guilty; in 1, the defendant was fined 2 cents; in 1, the defendant, upon a plea of guilty, was fined \$60; and in 1, a case of conspiracy to violate the food and drugs act, 4 defendants were sentenced to 1 year and 1 day each in prison, 2 received sentences of 6 months, and 1 was sentenced to 3 months in prison. At the close of the year 16 cases were pending in the courts.

#### PATENTS.

Seven applications for letters patent on inventions of employees of the department for dedication to the public were prepared and filed. During the year, 4 were allowed and 1 disallowed.

In addition, this office took testimony and prepared a brief in the interference declared by the Patent Office upon the application of Frank F. Chase, of this department, for letters patent on a gravity fruit separator and the application of George D. Parker for patent on the same invention.

The following table shows the status of applications on June 30, 1915:

Applicant.	Bureau.	Invention.	Disposition of application.
Robert M. Chapin.....	Animal Industry..	Process for preparation of concentrated animal dip.	Allowed.
Daniel W. Adams.....	Forest Service....	Turpentine hack.....	Do.
Robert G. Merritt.....	do.....	Hypsometer.....	Disallowed.
Orlin R. Rogers.....	Weather Bureau..	Apparatus for recording duration of rainfall.	Pending.
Frank F. Chase.....	Plant Industry....	Gravity fruit separator.....	Do.
Howard C. Pierce.....	Chemistry.....	Poultry picking frames.....	Do.
Herbert C. Gore.....	do.....	Process for making sirup from cider and other fruit juices.	Allowed.
Wm. H. Mast.....	Forest Service....	Planting board.....	Pending.
Jason L. Merrill.....	Plant Industry....	Process for making paper pulp from flax straw, flax tow, and other ligneous material.	Allowed.
Emil G. Boerner.....	do.....	Device for sampling, mixing, and blending grain, seeds, flour, meal, and other like material.	Pending.
Herbert C. Gore.....	Chemistry.....	Process for making sirup from sugar beets.	Do.
Marion Gilbert Donk.....	do.....	Process for producing high-grade rosin from low-grade rosin.	Do.
Marion Dorset and Howard J. Shore.....	Animal Industry..	Process for the manufacture of concentrated hog-cholera antitoxin.	Do.
Herbert H. Bunzel.....	Plant Industry....	Thermostat.....	Do.

### AGREEMENTS FOR THE SEVERAL BUREAUS, DIVISIONS, AND OFFICES.

The following table shows the number of contracts and leases prepared or examined for sufficiency and proper execution for the various bureaus, divisions, and offices of the department:

Bureau, division, or office.	Contracts.	Leases.	Bureau, division, or office.	Contracts.	Leases.
Bureau of Plant Industry....	75	53	Office of Experiment Stations.	2	25
Bureau of Animal Industry...	15	65	Bureau of Chemistry.....	2	7
Weather Bureau.....	68	70	Bureau of Entomology.....	1	35
Forest Service.....	1,673	242	Bureau of Biological Survey..	1	2
Office of Public Roads.....	15	7	Federal Horticultural Board..	1	1
Insecticide and Fungicide Board.....	6	1	Office of Markets.....	1	3
Library.....	1	1	Chief Clerk.....	9	17
Division of Publications.....	1	1			
Bureau of Soils.....	4	1		1,874	530

There were also prepared 14 bonds, 215 renewals, and 37 notices of terminations of contracts and leases.

### PUBLICATIONS OF THE OFFICE.

There was prepared a compilation of all Federal laws, committed to the Department of Agriculture for administration, providing for the control and suppression of infectious and communicable diseases of domestic animals, annotated by references to decisions of the courts, opinions of the Attorney General, and opinions of the Solicitor,



construing these laws. Included with this compilation was a revision of the previous publication of this office entitled "Twenty-eight-Hour Law Annotated."

The preparation of a second supplement to "Laws Applicable to the United States Department of Agriculture," begun during the previous fiscal year, was completed and a third supplement prepared and submitted for publication.

Under the authority of section 4 of the food and drugs act and section 4 of the insecticide act there were issued 737 notices of judgment.

During the year office circulars were issued containing decisions of the courts in the following cases:

Weeks v. United States (Circuit Court of Appeals, Second Circuit), Circular No. 81.

United States v. Boeckel & Co. et al. (Circuit Court of Appeals, First Circuit), Circular No. 82.

## REPORT OF THE INSECTICIDE AND FUNGICIDE BOARD.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
INSECTICIDE AND FUNGICIDE BOARD,  
*Washington, D. C., September 21, 1915.*

SIR: We have the honor to submit herewith a concise report on the work of the Insecticide and Fungicide Board for the fiscal year ended June 30, 1915.

Respectfully,

J. K. HAYWOOD,  
M. B. WAITE,  
A. L. QUAINANCE,  
JAMES A. EMERY,  
*Members.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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The insecticide act of 1910 places upon the department the responsibility of regulating interstate shipments and importations into the United States at its various ports of entry of insecticides and fungicides and also the manufacture and sale of such products in the Territories and the District of Columbia. The provisions of the law are designed to protect farmers, fruit growers, market gardeners, and stock and poultry raisers from fraudulent, misbranded, and adulterated insecticides and fungicides. Products used to rid the household of insects, and disinfectants, germicides, etc., which are used to combat or kill bacteria also come within the scope of the work. A violation of the act is punishable for the first offense by a fine and for a second offense by a fine or imprisonment, or both. The law also provides for the seizure of consignments of adulterated and misbranded products, thereby keeping the goods out of the channels of trade and away from the unsuspecting consumer.

The Insecticide and Fungicide Board, composed of scientists in the Bureaus of Chemistry, Plant Industry, Entomology, and Animal Industry, and working in cooperation with these bureaus, was organized in the department to assist the Secretary of Agriculture in the enforcement of the act. A force consisting of 49 scientists, inspectors, and other assistants is employed in the work.

A statistical statement of the samples taken and examined, seizures made, prosecutions brought, etc., conveys practically no idea of the volume of work involved and the effect produced on the quality of products. The result of the enforcement of the law is that the farming communities in particular are receiving much higher grades of insecticides and fungicides and articles of much more standard composition than they were receiving previous to the enactment of the law. The confidence established by this work greatly encourages the

manufacture and sale of legitimate materials and tends to encourage the use of these materials by farmers in preventing and combating diseases and insect pests of their crop plants and live stock.

### INTERSTATE SAMPLES.

During the fiscal year the board reported to the solicitor of the department 118 cases presenting alleged violations of law and with recommendations that the facts be transmitted to the Attorney General to institute criminal or seizure action. Disposition was made of 208 cases by correspondence with the manufacturers. These cases presented violations which were technical only, were not flagrant, or cases in which the manufacturer gave reasonable and adequate explanation of his failure to conform to the provisions of the act. Action was taken to place in abeyance 874 samples, which upon examination and test were shown to be in compliance with the provisions of the law, or were from shipments of the same goods made prior to shipments for which the manufacturer had been convicted and had after citation conformed to the requirements of the law. On June 30, 1915, 29 cases were pending preliminary hearings, 54 were before the board for final action, 280 were held in temporary abeyance pending the receipt of further information or the outcome of prosecutions based on the same product, or correspondence with the manufacturers, and 536 samples were undergoing analysis and test.

The inspectors and sample collectors of the board, operating throughout the United States, collected 1,117 samples during the year. A general classification of the articles represented in the collection is as follows:

Samples collected.	Number of samples.	Samples collected.	Number of samples.
Arsenate of lead.....	128	Formaldehyde preparations.....	10
Arsenate of lime.....	2	Insect preparations, household use.....	102
Arsenite of zinc.....	4	Kerosene emulsions.....	4
Bordeaux mixture and combination of		Lice and mite killers.....	89
Bordeaux mixture with insecticides..	77	Lime-sulphur solution and sulphur	
Chlorinated lime.....	13	preparations.....	69
Cyanides and cyanide mixtures.....	9	Nicotine preparations.....	27
Dips for animals.....	47	Paris green.....	36
Disinfectants, germicides, bacteriocides..	137	Pyrethrum and hellebore powders.....	39
Fly preparations, for animals.....	56	Miscellaneous.....	248
Fish-oil and whale-oil preparations.....	20		

### IMPORT SAMPLES.

During the year 94 official and unofficial import samples of insecticides and fungicides were collected by the various port laboratories of the Bureau of Chemistry for examination and test by the board. Disposition was made of 82 samples, 9 official samples being found adulterated or misbranded, or both, and it was recommended that entry to this country be entirely forbidden or that the consignments be released when correctly labeled. The remaining samples were unofficial, 13 of them being found to be adulterated or misbranded, or both, and in these cases it was recommended that future shipments be detained, while 60 were neither adulterated nor misbranded.



The following statistical statement of samples of certain commonly used spraying materials collected in connection with the enforcement of the law shows that a material stride has been made each year since the enactment of the law in securing compliance with its provisions:

*Percentage of violations.*

Shipped interstate, year.	Lead arsenate.	Paris green.	Lime- sulphur solution.	Bordeaux mixture and Bordeaux mixture combined with insecti- cides.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
1911-12.....	60	28	94	98
1913.....	30	21	86	71
1914.....	20	19	27	49

During the course of an investigation to determine how lead arsenates sold in interstate commerce should be labeled and to obtain scientific information relative to the preparation and properties of the various lead arsenates, the chemists working for the board, under the direction of the Bureau of Chemistry, have obtained data which have been offered for publication under the title "The Preparation and Properties of the Arsenate of Lead and Lead Chlor-Arsenate." Several new lead arsenates and lead chlor-arsenates have been prepared and their properties studied. The cause of injury to foliage by di-lead arsenate, of which several thousand tons are used annually for spraying purposes, has been found to be due in many cases to its decomposition by salts that occur naturally in the waters which are used for its application. A lead arsenate has been prepared which is soluble under these conditions, and this is now receiving careful field tests by the Bureau of Entomology.

An electrolytic method has been developed for the separation and determination of zinc, copper, and iron in the presence of arsenic, which has been published in the *Journal of Industrial and Engineering Chemistry*, January, 1915. A method has been perfected and offered for publication for the determination of arsenic in arsenates and the various insecticidal and fungicidal mixtures containing arsenates by reduction with cuprous chloride and separation of the arsenic by distillation. This work on new methods of analysis was found to be necessary to enable the board's chemists, working under the direction of the Bureau of Chemistry, to examine some of the various samples subject to the provisions of the act.

Plant pathologists of the board, working under the direction of the Bureau of Plant Industry, have performed a large amount of work to determine the efficacy of fungicides in controlling fungi attacking plants and the injury to vegetation of certain classes of insecticides and fungicides, which work has been of greatest service in enforcing certain of the provisions of the act. This work involved the making of 1,218 field tests, practically all of which required from one to six months to complete and a number extended over a period of one year.

Entomologists of the board, working under the direction of the Bureau of Entomology, have examined 485 cases. This work necessitated making 1,552 tests, and comprised the use of many thousand insects, representing insects frequenting the household, infesting vegetation, man, other animals, etc. The work also involved the testing relative to injurious action of insecticides on vegetation. In addition to the actual testing of proprietary insecticides, a large number of tests have been made of the various ingredients entering into the composition of insecticides to determine whether they were active or inert. These entomologists have also made various scientific investigations to obtain basic facts to aid in the enforcement of the law, as, for example, studying the action of naphthalene, sodium fluoride, different pyrethrum powders, tobacco powders, vegetable oils, etc., on insects, when used as dusts, sprays, or fumigants. The conditions under which many so-called liquid lice-killers will or will not be effective and the causes of injury to vegetation by certain kerosene emulsions have been made the subject of careful study.

While the information obtained by these special investigations is primarily used in the enforcement of the insecticide act and the general results have been published from time to time in the Service and Regulatory Announcements of the board for the benefit of the trade, a more detailed publication may be made by the bureau interested in bulletins of the department or in scientific journals of the United States.

## REPORT OF THE FEDERAL HORTICULTURAL BOARD.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
FEDERAL HORTICULTURAL BOARD,  
*Washington, D. C., September 17, 1915.*

SIR: I submit herewith an executive report covering the administration of the plant quarantine act for the fiscal year ended June 30, 1915.

Respectfully,

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

C. L. MARLATT,  
*Chairman of Board.*

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### FEDERAL PLANT QUARANTINE ACT.

Under the Federal plant quarantine act of August 20, 1912, the entry of foreign nursery stock and other plants and plant products into the United States is regulated, and domestic and foreign quarantines on account of plant diseases and insect pests are established and maintained.

### ADMINISTRATION AND PERSONNEL.

#### FEDERAL HORTICULTURAL BOARD.

The personnel of the Federal Horticultural Board, which administers the act, is as follows: C. L. Marlatt, chairman, Bureau of Entomology; W. A. Orton, vice chairman, Bureau of Plant Industry; George B. Sudworth, Forest Service; W. D. Hunter, Bureau of Entomology; Karl F. Kellerman, Bureau of Plant Industry. R. C. Althouse, secretary of the board, has charge of the administrative office.

#### FEDERAL AND STATE INSPECTION SERVICE.

The Federal and State inspection service remains substantially the same as last year, the Federal work having been under the charge of Mr. E. R. Sasscer and Mr. R. Kent Beattie. The number of State expert inspectors appointed as collaborators remains substantially the same as last year. Mr. H. B. Shaw remains as permanent inspector at the port of New York, where the great bulk of the nursery stock and other plant importations enters. His duties relate particularly to the inspection of plant importations from countries without inspection service and the inspection of potatoes and avocados offered for entry under the regulations requiring inspection.

Some minor work of an emergency character has been necessary in foreign countries in connection with foreign quarantines.

Similar field examinations and investigations have been necessary in connection with some of the domestic quarantines. This work has



been, for the most part, done in cooperation with the Bureaus of Entomology and Plant Industry by special expert agents detailed from these bureaus.

#### COOPERATION WITH OTHER DEPARTMENTS.

The enforcement of the foreign quarantines has been greatly facilitated by the continued cooperation on the part of the State Department and the Treasury Department, and the machinery of the Post Office Department was utilized in the enforcement of both the foreign and domestic quarantines.

It is very gratifying to note that the strict compliance by postmasters with the order of the Post Office Department to return to the country and place of origin as prohibited all plants for propagation sent by mail has had a very salutary effect. Such sendings are becoming less and less frequent, thus closing a very important avenue of danger of introduction of plant pests.

At the request of this department the mails have also been closed to the importation of raw cotton lint.

#### LEGISLATION PROVIDING FOR TERMINAL INSPECTION OF INTERSTATE MAIL SHIPMENTS OF PLANTS AND PLANT PRODUCTS.

There was incorporated in the agricultural appropriation act for the fiscal year 1916, following the appropriation for the enforcement of the plant quarantine act, legislation providing, under certain conditions, for terminal inspection of plants and plant products transmitted interstate through the mails. No appropriation is made by Congress for this purpose and all expenses arising thereunder are to be paid by the States invoking the benefits of the provision. This legislation will enable a State to control plant diseases and insect pests contained in mail shipments of plants from without the State. Heretofore, while a State could protect itself by quarantining against plants and plant products of other States so far as shipments by freight or express of these articles was concerned, the mails left an avenue for the entry and distribution without inspection of the quarantined articles. The danger from this source was greatly increased by the advent of the parcel post.

Any State wishing to take advantage of this new legislation must establish and maintain a terminal inspection service of plants and plant products at one or more places therein. A list of plants and plant products and the plant pests transmitted thereby, which in the opinion of the proper officials of a State should be subject to terminal inspection in order to prevent the introduction and dissemination in said State of pests injurious to agriculture, is to be submitted to the Secretary of Agriculture. Upon his approval of said list, in whole or in part, the Secretary of Agriculture shall transmit the list as approved to the Postmaster General, and thereafter all packages containing any plants or plant products named in said approved list shall, upon payment of postage therefor, be forwarded by the postmaster at the destination of said package to the proper State official at the nearest place where inspection is maintained. If the plant or plant products are found upon inspection to be free from injurious pests, or, if infected, shall be disinfected by said official, they shall, upon payment of postage therefor, be returned to the postmaster at the place

of inspection to be forwarded to the person to whom they are addressed; but if found to be infected with injurious pests and incapable of satisfactory disinfection, the State inspector shall so notify the postmaster at the place of inspection, who shall promptly notify the sender of said plants or plant products that they will be returned to him upon his request and at his expense, or, in default of such request, that they will be turned over to the State authorities for destruction. The act requires all such packages to be plainly marked, so that their contents may be readily ascertained by an inspection of the outside thereof. Whoever fails to so mark said packages shall be punished by a fine of not more than \$100. Rules and regulations for carrying out the purposes of the above act have been prescribed by the Postmaster General. The State of California, which was particularly active in securing this legislation, was the first one to take advantage of its provisions. At least one other State is contemplating similar action.

## REVIEW OF THE WORK OF THE YEAR.

### NEW PLANT QUARANTINES AND RESTRICTING ORDERS.

The domestic and foreign quarantines, described below, are additional or supplementary to the quarantines reported last year.

#### FOREIGN QUARANTINES.

**FOREIGN POTATO QUARANTINE.**—Amendment 5, promulgated November 30, 1914, to Quarantine No. 11, eliminates the Dominion of Canada from the provisions of Quarantine No. 11, and provides for the importation from the Dominion of Canada of potatoes free from potato wart and powdery scab, in accordance with the regulations prescribed under the order of the Secretary of Agriculture of December 22, 1913, governing the admission of foreign potatoes under restriction.

**CITRUS NURSERY STOCK QUARANTINE.**—Quarantine No. 19, promulgated December 10, 1914, forbids the introduction into the United States of all citrus nursery stock, including buds, scions, and seeds, from all foreign countries and localities, to prevent the further introduction into the United States of citrus canker and other dangerous citrus diseases.

**PINE QUARANTINE.**—Quarantine No. 20, promulgated March 1, 1915, forbids the importation into the United States on and after July 1, 1915, of all pines from all European countries and localities, to prevent the further introduction into the United States of the European pine-shoot moth (*Evetria buoliana*).

**INDIAN CORN QUARANTINE.**—Quarantine No. 21, promulgated March 8, 1915, forbids the importation into the United States of all Indian corn from Java and India, and Oceania except Australia and New Zealand, to prevent the introduction into the United States of a serious disease of Indian corn known as *Sclerospora maydis*.

#### DOMESTIC QUARANTINES.

**MEDITERRANEAN FRUIT FLY AND MELON FLY QUARANTINE.**—Amendment 1, promulgated April 2, 1915, to Quarantine No. 13, provides for the posting, at designated places, of a circular to be furnished by

the United States Department of Agriculture, calling attention to the provisions of the plant quarantine act, Quarantine No. 13, and the regulations prescribed therein.

**POWDERY SCAB OF POTATO.**—Quarantine No. 18, promulgated November 14, 1914, regulates the movement of potatoes from Clinton and Franklin Counties, N. Y., on account of the occurrence in these counties of the dangerous potato disease known as powdery scab (*Spongospora subterranea*). This quarantine order supplements Notice of Quarantine No. 14, issued April 25, 1914, designed to prevent the further distribution in the United States of powdery scab from certain portions of the State of Maine. The regulations governing the interstate movement of potatoes from areas quarantined for powdery scab, issued under the latter quarantine order, apply also to the area quarantined in the State of New York. These quarantines are administered under a special appropriation, providing for cooperation on the part of the States concerned.

**GIpsy Moth and Brown-Tail Moth Quarantine.**—Quarantine No. 22, promulgated May 20, 1915, was originally issued November 5, 1912, as Quarantine No. 4, and has been revised and amended annually to include the new territory invaded by the gipsy moth and the brown-tail moth. This quarantine describes the districts in New England infested by the two moths named, and prohibits the movement in interstate commerce of plants and plant products except in accordance with the regulations prescribed therein. The spread of the brown-tail moth during the year was so slight that it was found unnecessary to extend the quarantine line on account of this insect. The gipsy moth, on the contrary, extended its range considerably, its principal spread, fortunately, being northward and eastward.

Hitherto the interstate shipment of Christmas trees and Christmas greens from the area infested with the gipsy moth to points outside the quarantined area was prohibited, owing to the extreme difficulty of making a thorough inspection of products of this character and the fact that an abundant supply was available outside of the gipsy-moth territory. Now that the gipsy-moth quarantine line has been considerably extended, and at the earnest and insistent request of Christmas-tree merchants and certain other interests, it was decided to give the shipment of such products a trial next season, and the regulations under the above quarantine order have been amended to provide for the inspection and certification for shipment of Christmas trees and greens.

As in former years, the cost of administering this quarantine was paid out of the special appropriation for preventing spread of moths, granted to the Bureau of Entomology.

**HAWAIIAN COTTON.**—Quarantine No. 23, promulgated June 11, 1915, forbids the movement from Hawaii into or through any other State, Territory, or District of the United States of raw or unmanufactured cotton lint except in accordance with the regulations prescribed therein, with the object of preventing the introduction into the continental United States of the pink bollworm (*Gelechia gossypiella*).



## ORDER RESTRICTING THE ENTRY OF COTTON LINT.

Under the authority contained in section 5 of the plant quarantine act an order placing restrictions on the importation of cotton lint into the United States, and regulations governing the importation of cotton lint under said order, were issued April 27, 1915. The object of this order is to prevent the entry into the United States with raw cotton of the pink bollworm and other injurious insects. In my report last year reference was made to the finding of living larvæ of the pink bollworm in seed contained in baled Egyptian cotton and of the consequent danger of the unrestricted use of such cotton. The regulations provide for the entry at northern ports only of foreign cotton under permit and for a system of notifications which enables the board to keep track of all imported cotton until it is consumed. No person, firm, or corporation is allowed to purchase, use, or store foreign cotton until a license therefor has been secured from the Secretary of Agriculture, and all licensees agree to fully comply with the requirements of the regulations, including the screening of all windows and other openings in the warehouse, opening and picker rooms, and the burning at the close of each day of all picker waste and seeds.

In addition to the precautions which are now being taken, all cotton arriving in this country on and after February 1, 1916, must be disinfected at port of entry by fumigation with hydrocyanic-acid gas in a vacuum, under the supervision of an inspector of the Department of Agriculture, before it will be released. Extensive experiments have demonstrated that such fumigation is entirely practicable and thoroughly effective in destroying all contained insect life, the gas penetrating to the innermost parts of the bale. Tests of yarn and fabric made from cotton so treated failed to show any injurious effect whatever as a result of this treatment.

Subsequent to the discovery of the occurrence of infested seed in baled Egyptian cotton, cotton importers and cotton manufacturers have heartily cooperated with the department in its effort to prevent the establishment of the pink bollworm in the United States, and during the past year practically every mill using foreign cotton has, at the suggestion of this department, been burning the picker waste from such cotton.

The cotton-lint regulations referred to above do not apply to the States of Nuevo Leon, Coahuila, Durango, Chihuahua, Tamaulipas, and Lower California, Mexico.

## NURSERY-STOCK IMPORTATIONS.

There has been no material change in the system of control of imported nursery stock established in the first year of the enforcement of the plant quarantine act.

## FOREIGN COUNTRIES MAINTAINING INSPECTION SERVICE.

The following countries have provided for inspection and certification in conformity with the regulations under the plant quarantine act:

Australia.	Ireland.	New Zealand.
Barbados.	Italy—Province of Padova	Philippine Islands.
Belgium.	(Padua) only.	Scotland.
Bermuda.	Jamaica.	Union of South Africa.
British Guiana.	Japan.	Spain.
Canada.	Leeward Islands:	Straits Settlements.
Cuba.	Antigua.	Switzerland.
Denmark.	St. Christopher-Nevis.	Trinidad.
England.	Dominica.	Wales.
France.	Montserrat.	Windward Islands:
Germany.	Virgin Islands.	Granada.
Guatemala.	Grand Duchy of Luxem-	St. Lucia.
Holland.	burg.	St. Vincent.

This list includes practically all of the countries which have hitherto maintained any considerable commercial trade in nursery stock with the United States. Any other country may obtain the privilege of commercial exportation to the United States by providing an inspection service.

Both importers and exporters of nursery stock generally have made an honest effort to comply with the law and to meet all of its requirements, and in only a few instances has it been necessary to return shipments of nursery stock or to destroy the stock on account of infestation.

## DISTRIBUTION OF IMPORTED NURSERY STOCK, BY STATES.

The following table indicates the distribution, by States, of nursery stock imported during the fiscal years 1913-14 and 1914-15:

*Distribution of imported nursery stock, by States.*

State.	Number of cases.		State.	Number of cases.	
	1914-15	1913-14		1914-15	1913-14
Alabama.....	241	125	Montana.....	20	26
Arizona.....		4	Nebraska.....	217	149
Arkansas.....	95	11	Nevada.....	1	2
California.....	3,357	1,929	New Hampshire.....	53	57
Colorado.....	150	152	New Jersey.....	8,829	10,458
Connecticut.....	1,372	1,432	New Mexico.....		1
Delaware.....	40	38	New York.....	12,669	12,363
District of Columbia <sup>1</sup> .....	549	562	North Carolina.....	80	162
Florida.....	2,461	56	North Dakota.....	12	8
Georgia.....	228	196	Ohio.....	3,374	3,068
Hawaii.....	20	4	Oklahoma.....	15	13
Idaho.....	5	9	Oregon.....	480	560
Illinois.....	3,316	3,942	Pennsylvania.....	6,556	9,309
Indiana.....	569	545	Rhode Island.....	741	606
Iowa.....	1,066	394	South Carolina.....	39	41
Kansas (north).....	51	49	South Dakota.....	16	16
Kansas (south).....	292	236	Tennessee.....	197	200
Kentucky.....	320	352	Texas.....	139	184
Louisiana.....	400	416	Utah.....	27	35
Maine.....	42	51	Vermont.....	24	20
Maryland.....	756	553	Virginia.....	354	338
Massachusetts.....	4,221	5,115	Washington.....	403	482
Michigan.....	1,562	1,232	West Virginia.....	87	102
Minnesota.....	701	528	Wisconsin.....	430	334
Mississippi.....	23	35			
Missouri.....	592	676	Total.....	57,192	57,525

<sup>1</sup> In addition to the commercial shipments referred to above, some 1,890 departmental importations for scientific purposes have been inspected by inspectors of the Federal Horticultural Board.

COUNTRY OF ORIGIN AND NATURE OF NURSERY-STOCK IMPORTATIONS.  
*Country of origin and classes of plants and seeds imported during the year ended June 30, 1915.*

Country.	Fruit trees.	Fruit-tree stocks.	Grape-vines.	Bush fruits.	Roses.	Rose stocks.	Forest and ornamental deciduous trees.	Ornamental deciduous shrubs.	Coniferous trees other than pines.	Pines.	Evergreen trees.	Evergreen shrubs.	Field-grown florists' stock.	Stocks, cuttings, or seedlings.	Tree seeds.
Argentina Republic.															
Australia.															
Austria.															
Azores.	22					12	12					30	7,776	324	2,992
Bahama Islands.							5					44	5		7,367½
Belgium.	197											2			
Bermuda.							5,080	31,744	53,344		15,217	880,523	143,617	405	6,667
Brazil.								1,001	56				2,534		254,001
Canal Zone.													4,930		
Canada.	897						41	503	197			25	501		545
China.	24												20		
Colombia.													73,420		
Costa Rica.													100		
Cuba.								4,000				2	1,131,511		65
Denmark.								2,504							
England.	16,974	3,750					23,625	14,377	253,849	12,442	23,737	45,688	15,977	1,212	
France.	3,662,119	21,506,165	79,377				711,221	2,733,630	699,398	79,277	90,147	510,938	115,300	8,702,324	40,053½
Germany.	85						111,550	5,557				8,067	1,351		821¼
Grand Duchy of Luxembourg.															
Guatemala.															
Holland.	103,518	135,400	406				393,220	784,279	353,376	36,175	86,374	1,231,905	276,632	408,343	6
Honduras.													21		
Hungary.															
India.															
Ireland.															
Italy.	56						35								
Jamaica.							5	8,000	5						
Japan.	37,167	132	30				41,105	15,171	11,202	2,712	7,507	8,341	96,621	4,753	1,325
Leeward Islands.															
Mexico.	200						100	2							
New South Wales.															
New Zealand.															
Nicaragua.															
Norway.															
Panama.															
Philippine Islands.															
Scotland.	301														
Sweden.	2						1,375	3,109	5,500		1,066	2,743	1,793		
Switzerland.	12							2	18		10	464			
Trinidad.															
Venezuela.								5							
Total.	3,821,574	21,645,672	81,072	192,076	3,516,598	5,808,814	1,287,274	3,612,931	1,377,915	130,606	224,165	2,668,887	1,958,587	9,184,840	322,628



## RESULTS OF STATE AND FEDERAL INSPECTION OF IMPORTED PLANTS AND PLANT PRODUCTS.

As the result of State and Federal inspection the following pests were intercepted during the year: Egg masses of the gipsy moth were taken on six different occasions on stock received from Belgium, Holland, and Japan. Nests of the brown-tail moth were detected on three consignments of nursery stock, one from Ireland and two from France. Puparia of the European tussock moth (*Notolophus antiqua*) have been frequently collected on stock from France and Holland. The European pine-shoot moth (*Evetria buoliana*), which is a serious enemy to pine forests in Europe, has been detected on pine seedlings from Holland on no less than 23 different shipments. A closely related species, *E. resinella*, has also been taken on pine seedlings from Holland. Citrus stock from Brazil was found infested with one of the white flies, *Aleurothrixus floccosa*, which is not as yet established in the States. The same material was also infested with an undescribed chaff scale (*Parlatoria* sp.). Citrus cuttings from the Philippine Islands exhibited a thick infestation of the black chaff scale (*Parlatoria zizyphus*). An undescribed *Aonidia* was found thickly infesting the upper surface of the foliage of "cambuca" (*Myrciaria plicato-coactata*) from Brazil. Yams from the Philippine Islands exhibited a severe infestation with the tuber scale (*Targionia hartii*). Larvæ of what appeared to be one of the potato weevils, *Rhigopsidius tucumanus*, referred to in last year's report, were again found in potatoes from Peru.

Pear seedlings from France have been found thickly infested with the European pear scale (*Epidiaspis piricola*).

Avocado seed from Guatemala, imported under special permit, were found to be riddled with galleries made by the larvæ of a species of weevil (*Conotrachelus* sp.).

In addition to the above, many insects of greater or less importance have been taken on plants of various descriptions. In all, some 165 species of insects have been reported on imported stock during the past year.

A single infection of the common scab (*Oospora scabies*) was discovered on potatoes from Canada. Potatoes from Canada were also found to be affected with *Rhizoctonia* and silvery scurf (*Spondylocladium atrovirens*). Powdery scab (*Spongospora subterranea*) was detected by inspectors of the State of Washington on potatoes from British Columbia.

Citrus canker was discovered on four shipments of citrus bud wood and on a collection of citrus herbarium material from the Philippine Islands. These interceptions were particularly fortunate in view of the fact that a part of the shipments were destined to go to citrus regions of California. Four shipments of citrus were found infected with wither tip (*Colletotrichum glæosporioides*), three of which were received from the Philippine Islands and one from Japan. Melanose (*Phomopsis citri*) was detected by the California authorities on citrus from Japan. Kudzu from Japan was found to be affected with a rust known scientifically as *Woroninella puerariæ*.

In addition to the above, it was possible to identify the causal organism of some 85 specific diseases entering on imported stock.

## REGULATORY INVESTIGATIONS.

## FOREIGN INVESTIGATIONS.

The exigency created by the discovery of living larvæ of the pink bollworm in seeds of cotton contained in bales of imported Egyptian cotton, referred to in preceding pages, made it essential for this board to have additional information in regard to the life history of the pink bollworm and its damage to cotton and other plants. Early in May, 1915, an entomological assistant of the Bureau of Entomology was commissioned to go to the islands of Oahu and Hawaii to secure first-hand information on these points. Information furnished by him relative to the ability of the larva to easily penetrate closely woven cloth has already resulted in amending the Regulations Governing the Importation of Cotton Lint into the United States by eliminating the requirement that broken bales be patched at port of entry.

A number of permits were issued in the early summer of 1915 for the importation of potatoes from British Columbia, as the Department had information to the effect that the western coast of Canada was free from powdery scab. Notwithstanding this information, several suspicious looking imported potatoes, forwarded to Washington by our inspector at Seattle, proved to be infected with this disease. A scientific assistant of the Bureau of Plant Industry, then stationed at Jerome, Idaho, was authorized to proceed to British Columbia to determine, if possible, the source of the diseased potatoes. He found powdery scab at a number of places in British Columbia, and as a consequence all permits to import potatoes were promptly revoked.

## DOMESTIC INVESTIGATIONS.

The investigations necessary to the determination of quarantine lines and as a basis for proper regulatory action in connection with domestic quarantines have been conducted in cooperation with the Bureau of Plant Industry in relation to the potato quarantine, and in cooperation with the Bureau of Entomology in relation to the moth quarantine in New England. No special investigations were necessary in relation to any of the other domestic quarantines.

## LIST OF PLANTS AND PLANT PRODUCTS COVERED BY QUARANTINE.

The following is a list of the plants and plant products now under quarantine in accordance with the various notices of quarantine issued up to June 30, 1915:

Irish potatoes from Newfoundland, the islands of St. Pierre and Miquelon, England, Scotland, Wales, Ireland, and continental Europe, except Denmark and part of the Netherlands. The quarantine is still in force against the Provinces of Drenthe and Groningen in the Netherlands. There are no restrictions on the entry of foreign potatoes into the island of Porto Rico.

Irish potatoes from the States of Maine and New York, except under rules and regulations prescribed.<sup>1</sup>

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<sup>1</sup> Discontinued Sept. 1, 1915.

Cotton seed (including seed cotton) of all species and varieties and cottonseed hulls from all foreign localities and countries except the States of Neuvo Leon, Tamaulipas, Coahuila, Durango, Chihuahua, and Lower California, Mexico. Cotton seed (including seed cotton) of all species and varieties from the Mexican States mentioned may be imported under permit and bond for manufacturing purposes only. No restriction is placed on the use of cottonseed hulls imported from said States, or which may be obtained from cotton seed imported from said States.

Cotton seed and cottonseed hulls from Hawaii.

Seeds of the avocado or alligator pear from Mexico and the countries of Central America.

Oranges, sweet limes, mangoes, *Achras sapotes*, peaches, guavas, plums, and grapefruit, and their horticultural varieties, from Mexico.

All citrus nursery stock, including buds, scions, and seeds, from all foreign localities and countries. The term "citrus" as used here includes all plants belonging to the subfamily or tribe *Citratæ*.

Any fruit or vegetable from Hawaii upon which the Mediterranean fruit fly or the melon fly breeds, or which, from proximity of growth or the requirement of packing and shipping, may carry infestation, including alligator pears, bananas, carambolas, Chinese ink berries, Chinese oranges, Chinese plums, coffee berries, cucumbers, damson plums, eugenias, figs, grapes, grapefruit, green peppers, guavas, kamani nuts, kumquats, limes, loquats, mangoes, mock oranges, mountain apples, melons, Natal or Kafir plums, oranges, papayas, peaches, persimmons, pineapples, prickly pears, rose apples, star apples, string beans, squashes, and tomatoes, except that bananas and pineapples may be moved from the Territory of Hawaii in manner or method or under conditions prescribed in the regulations of the Secretary of Agriculture.

Cotton lint from Hawaii may be shipped to the continental United States only in accordance with the regulations prescribed in the notice of quarantine.

Living canes of sugar cane, or cuttings or parts thereof, from all foreign countries and from Hawaii and Porto Rico. There are no restrictions on the entry of such material into Hawaii and Porto Rico.

Indian corn from Java and India and Oceania, except Australia and New Zealand.

All five-leaved pines<sup>1</sup> from Europe and Asia.

Date palms or date-palm offshoots from Riverside County, Cal., east of the San Bernardino meridian; Imperial County, Cal.; Yuma, Maricopa, and Pinal Counties, Ariz.; and Webb County, Tex., shall be moved only in accordance with the rules and regulations applicable thereto.

Coniferous trees, such as spruce, fir, hemlock, pine, juniper (cedar), and arbor vitæ (white cedar), known and described as "Christmas trees," and parts thereof, and decorative plants of the area quarantined for the gipsy moth (certain parts of New England), such as holly and laurel, known and described as "Christmas greens or greenery,"<sup>2</sup> shall not be moved or allowed to move interstate to points outside the quarantined area.

<sup>1</sup> On and after July 1, 1915, all pines from all European countries and localities will be excluded.

<sup>2</sup> It is proposed to allow the movement of these articles on and after July 1, 1915, under regulation.



Forest plant products, including logs, tan bark, posts, poles, railroad ties, cordwood, and lumber, and field-grown florists' stock, trees, shrubs, vines, cuttings, and other plants and plant products for planting or propagation, of the area quarantined for the gypsy moth (certain parts of New England), excepting fruit pits, seeds of fruit and ornamental trees and shrubs, field, vegetable, and flower seeds, bedding plants, and other herbaceous plants and roots, shall not be moved or allowed to move interstate to any point outside the quarantined area unless and until such plants and plant products have been inspected by the United States Department of Agriculture and pronounced free from the gypsy moth.

Deciduous trees or shrubs of the area quarantined for the brown-tail moth (certain parts of New England), or such parts thereof as bear leaves, including all deciduous field-grown florists' stock, vines, cuttings, grafts, and scions, but excepting forest-plant products, such as logs, tan bark, posts, poles, railroad ties, cordwood, and lumber, shall not be moved or allowed to move interstate to points outside the quarantined area unless and until such plants and plant products have been inspected by the United States Department of Agriculture and pronounced to be free from the brown-tail moth. Coniferous trees and other evergreen trees are not affected by the brown-tail moth regulations.

In the case of all foreign quarantines the embargo is absolute.



## REPORT OF THE CHIEF OF THE OFFICE OF MARKETS AND RURAL ORGANIZATION.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
OFFICE OF MARKETS AND RURAL ORGANIZATION,  
*Washington, D. C., October 1, 1915.*

SIR: I have the honor to transmit herewith a report of the work of the Office of Markets and Rural Organization for the fiscal year ended June 30, 1915.

Respectfully,

CHARLES J. BRAND,  
*Chief of Office.*

Hon. D. F. HOUSTON,  
*Secretary of Agriculture.*

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### GENERAL STATEMENT.

In the miscellaneous section of the act making appropriations for the Department of Agriculture for the fiscal year ended June 30, 1914, a paragraph carried \$50,000 for the acquisition and diffusion of useful information on subjects connected with the marketing and distributing of farm products.

In the appropriation for the following year a similar paragraph was headed "Office of Markets," and the amount increased to \$200,000. A new paragraph was placed in the miscellaneous section of the same bill appropriating \$40,000 for a study of cooperation among farmers in the United States.

In the bill for the fiscal year ending June 30, 1916, both of these appropriations were removed from the miscellaneous section and combined in an appropriation for the Office of Markets and Rural Organization, with the total amount increased to \$484,050. Of this sum, \$75,000 was appropriated for the enforcement of the United States cotton futures act. This act was approved on August 18, 1914, and was designed "to tax the privilege of dealing on exchanges, boards of trade, and similar places in contracts of sale of cotton for future delivery and for other purposes." According to its provisions certain sections of this act were to be administered by the Department of Agriculture, and the Secretary made the Office of Markets and Rural Organization responsible for the consideration of all matters pertaining thereto. The act carried a continuing appropriation of \$150,000 available for expenditures by the Department of Agriculture. Of this sum, \$50,000 was set aside for expenditure during the fiscal year ending June 30, 1915, leaving a



balance of \$100,000 available for the continuation of the work, in addition to the amounts provided therefor in annual appropriations.

The appropriation act for the fiscal year 1916 transferred from the Bureau of Plant Industry to the Office of Markets and Rural Organization the appropriation for the work on cotton standards. In order to coordinate the related lines of work as soon as possible, they were placed under one supervision by direction of the Secretary, effective April 1, 1915.

Owing to these accessions and to the development of the work of the office as originally planned, it has been necessary to make many additions to the staff of the office, both scientific and clerical. The rate of increase in its personnel was 164 per cent, the staff numbering 83 members on July 1, 1914, and 219 on July 1, 1915.

In December, 1914, the office was moved into new quarters in a new building, making it possible to harmonize the physical location of the staff with its logical organization, with a consequent increase in efficiency of administration and decrease in waste motion. More adequate equipment was installed at this time and at subsequent dates.

During the course of the year the Office of Markets and Rural Organization published 7 bulletins of the Department Series, 2 Farmers' Bulletins, 3 articles in the Department Yearbook, 4 Service and Regulatory Announcements, 2 Circulars of the Office of the Secretary, and 1 Document of the House of Representatives, containing in all 383 pages. In addition to this, a bulletin was issued in cooperation with the Bureau of Crop Estimates, and many miscellaneous articles were printed in the Agricultural Outlook and elsewhere. Other manuscripts have been submitted for publication but have not yet been issued.

A great deal of preliminary work has been done in establishing the new projects of the office. Two of these—Marketing Live Stock, Meats, and Animal By-products and Marketing Business Practice—were approved by the Secretary during the month of April, 1915; another project, Marketing Dairy Products, was approved on June 18, 1915; several others were submitted for approval late in the fiscal year but were not passed upon until after its close.

As this is the first report for a full fiscal year of most of the projects of this office, it is given in considerable detail, that it may serve as a basic report in future years.

## MARKETING AND DISTRIBUTING FARM PRODUCTS.

Fourteen projects are grouped under this general heading. They include the original projects of this office with several additions.

### COOPERATIVE PURCHASING AND MARKETING.

During the fiscal year ended June 30, 1915, the work on this subject has been a continuation of work started in the previous year. The survey of farmers' organizations has produced additional information. The names of over 1,000 old associations and newly formed ones have been added to the list, which now includes over 11,000 entries. Information as to their formation and system of operation has been secured. It has been found that of this large

number of organizations only about one-sixth are truly cooperative, most of the organizations being governed and profits paid on the basis of capital invested. Many of these capitalistic associations are now being reorganized under new cooperative laws, and this office has drawn plans for reorganizing 12 of them on the basis of no capital stock, nonprofit, and the payment of patronage dividends, with a one-vote membership control. It has also been found that most of these organizations are held together by a loosely drawn membership agreement, with penalty clauses that are clearly illegal. A membership agreement which bases all sales upon a legally drawn power of attorney has been prepared so as to give more stability to farmers' selling organizations.

#### STUDY OF COOPERATION IN THE UNITED STATES.

The survey of cooperation in the United States shows that it is far more prevalent than is generally believed, though not upon as strong a business basis as is needed. It is estimated that the farmers' cooperative marketing and purchasing organizations will transact this year a total business amounting to more than \$1,400,000,000. The conclusion seems warranted that in communities where cooperation is practically applied to the farmers' business the results obtained are far more satisfactory than those secured by individual methods.

An effort has been made to strengthen existing organizations and to guide new associations as far as practicable so that they may serve their members more effectively and avoid the many difficulties and failures which have resulted in the past from lack of experience and foresight.

#### STATE COOPERATIVE LAWS.

The laws of the various States relating to the formation and management of farmers' cooperative associations are being collected in collaboration with the Office of the Solicitor, and a digest of them is being prepared. A study of these laws shows that there is a great diversity among the laws of the various States under which farmers' marketing organizations can be chartered. In fact, a majority of States make it necessary to organize under the regular corporation law, which makes no provision for the distribution of profits on the basis of the amount of sales and purchases made by the farmer with the organization. Drafts of proposed new laws to encourage cooperation in Oregon, Montana, Colorado, Wyoming, and Oklahoma have been prepared by State authorities and forwarded to this office for suggestions regarding improvement. In the case of 12 new associations, the necessity of conforming to State and Federal laws compelled the preparation of complete forms of by-laws. This work was done for associations in the State of Florida, Virginia, Michigan, Tennessee, Maryland, and Pennsylvania.

First-hand knowledge of the individual problems of cooperative organizations is essential for giving the most helpful service. Personal visits have been made to existing and prospective organizations of farmers in Maine, Michigan, Oregon, Utah, Washington, Idaho, Colorado, Kentucky, Louisiana, Virginia, West Virginia, Maryland,

and Arkansas, and definite advice has been given regarding plans of organization and methods of operation. Extensive work has been done among the fruit growers generally, the nut growers of the South, the cane and sorghum sirup makers of the South, the bean growers of Michigan and California, and the tobacco growers of Virginia, North and South Carolina, Maryland, and Kentucky. In addition to the direct aid given in this way, much valuable information has been accumulated and is being prepared for publication.

Publications dealing with various phases of cooperative marketing have been issued. A treatment of the general principles involved in the organization and maintenance of cooperative marketing associations was published in the Yearbook for 1914, and was reprinted as Yearbook Separate No. 637: Cooperative Marketing and Financing of Marketing Associations. Farmers' Bulletin No. 656: The Community Egg Circle, was also issued, both publications being now in the second edition.

Much of the work reported under Marketing Business Practice was planned and conducted under this project before that work became a separate undertaking. The work under Cooperative Purchasing and Marketing is carried on by Messrs. Charles E. Bassett and Charles W. Moomaw.

#### MARKETING BUSINESS PRACTICE.

The investigations relating to the accounting, auditing, financing, and general business practices of cooperative organizations, which were conducted during the last fiscal year under the project Cooperative Purchasing and Marketing have been transferred to a new project, that of Marketing Business Practice.

#### COOPERATIVE ORGANIZATION BUSINESS METHODS.

After a comprehensive investigation of the accounting methods in use by cooperative marketing organizations throughout the United States it was found that there was a dire need for a text or hand book relating to the general business practices of these organizations, stated in simple form and giving plans for the business organization and the general business requirements for conducting a cooperative marketing organization. To answer this need a manuscript was prepared and published as Department Bulletin No. 178: Cooperative Organization Business Methods. This bulletin was issued in March, and exhausted. This publication serves as a guide in formulating the plans for the business organization of a cooperative marketing association and contains general accounting and business-practice information of material interest to officers and members of such associations.

#### COUNTRY GRAIN ELEVATORS: SYSTEM OF ACCOUNTS, BUSINESS PRACTICES.

The system of elevator accounts which had been installed at the date of our last report, for experimental operation in four farmers' elevators in the Northwest was installed in other elevators, making a



total of 14 country elevators, located in seven States, in which this accounting system was tried out in actual operation. After a season's use in these organizations it was believed to have been developed to a point where it was worthy of recommendation to country elevators as a uniform system of accounts. To this end Department Bulletin No. 236, *A System of Accounts for Farmers' Cooperative Elevators*, was issued. This bulletin contains reproductions of the forms comprising the system, describes in detail their uses, and contains the necessary information for the installation and operation of the system, together with material relating to the business methods of these enterprises. Printers' copies of the various forms were prepared for distribution to elevators desiring to consider the system for installation. Seven hundred and forty-six widely distributed elevators have requested these forms, and more than one hundred elevators were using them on June 30, 1915. Various printing firms throughout the country are printing the system, and it is obtainable at a nominal cost. Indications are that during the fall of 1915 and the following spring the system will be installed generally by country elevators. Owing to the demand it has been necessary to request a second edition of the bulletin describing the operation of this system.

#### COOPERATIVE FRUIT ORGANIZATIONS: SYSTEM OF ACCOUNTS, BUSINESS PRACTICES.

The system of accounts devised for cooperative fruit organizations, which was tried in experimental operation during the last fiscal year in three large fruit and produce exchanges, so well answered the purposes of a complete system of accounts for these organizations that it was considered advisable to recommend it as a uniform system for small cooperative fruit associations. The system and description of its operation was published as Department Bulletin No. 225: *A System of Accounting for Cooperative Fruit Associations*. Printers' copies of all the forms described in the bulletin were prepared and made available for general distribution. At the end of the fiscal year 55 fruit associations had requested copies of these forms and were considering the installation of the system.

Inasmuch as the bulletin was not available for general distribution until May 1, 1915, but few organizations have had time to install the system, although it is now in use in 15 fruit associations located in different parts of the country.

#### COOPERATIVE PRODUCE ORGANIZATIONS: SYSTEM OF ACCOUNTS, BUSINESS PRACTICES.

A system of accounts has been devised for those produce exchanges which buy the members' products outright. Inasmuch as there are but a few of these organizations in the United States, it was not deemed advisable to place the system in bulletin form. However, printers' copies of the forms have been prepared and a description of their uses is available for distribution to organizations desiring to consider the system for installation. This system will be of greatest service to the small produce organizations in the South and West. At the close of the fiscal year requests from 37 produce organizations had been received for copies of the forms comprising this system.

## LIVE-STOCK SHIPPING ASSOCIATIONS: SYSTEM OF ACCOUNTS, BUSINESS PRACTICES.

A system of accounts for live-stock shipping associations has been devised, this system having been prepared after an extensive investigation of the accounting and business methods of live-stock shipping associations. The system will be installed during the fiscal year 1916 for experimental operation in one organization in each of the following States: Michigan, Minnesota, and Wisconsin. After an experimental operation covering a year's business, if the system proves successful it will be made available for adoption by live-stock shipping associations generally.

## RURAL CREAMERIES: SYSTEM OF ACCOUNTS, BUSINESS PRACTICES.

During the past year an extensive investigation was made of the accounting and business-practice methods of rural creameries. About 25 creameries, located in the States of Minnesota, Iowa, Illinois, Michigan, Wisconsin, Indiana, and Kentucky were visited and a detailed study was made of their business methods. This investigation showed that there was a great need for some business system which could be adopted generally by these enterprises, and which could be used with but few changes by both large and small concerns. A system of accounts has been devised and arrangements have been made to install it in one creamery in each of seven States. It is the intention to try this system in experimental operation until it has been developed to such a point that it is deemed of sufficient worth to be recommended as a uniform system of accounts for rural creameries. When this system is perfected it is intended to place it in bulletin form together with other information relating to the business methods of these enterprises. The work in perfecting this system is conducted in close cooperation with the Dairy Division of the Bureau of Animal Industry.

## FINANCING COOPERATIVE MARKETING ASSOCIATIONS.

In starting a cooperative organization one of the most serious problems is that of financing its operation. Very few of these organizations have paid-in capital stock or surplus or other assets which are liquid, sufficient to meet the expenses of the business during the heavy marketing season. It is necessary therefore to secure funds from outside sources for these purposes. From the investigations of this office relating to cooperative organizations it was found that practically none of the smaller organizations have any idea as to the possibilities for developing credit and securing the necessary funds for conducting their business along approved and efficient lines. It was deemed advisable, therefore, to make a complete investigation of the financing of cooperative marketing associations, and ascertain, if possible, the methods used by the successful organizations in financing their enterprises.

Personal visits were made to cooperative organizations in 17 States. The managers were interviewed, methods and plans of financing secured, and bankers and others making loans to the business were consulted. Bankers in Los Angeles, Portland, San Francisco, Denver, New York City, Chicago, and Philadelphia were interviewed for the purpose of ascertaining to what extent loans were made to

cooperative organizations or to smaller banks who in turn loaned to cooperative organizations, the security required, and the methods of obtaining these loans. Circulars were forwarded to over 300 organizations scattered throughout the country, and from those returned information as to the financing of over 175 cooperative organizations was secured. From a study of this material it has been possible to make recommendations to various organizations throughout the country as to plans of financing and to make certain suggestions as to the type of organization which will be most successful from a financing standpoint.

#### COOPERATIVE RETAIL STORES : INVESTIGATION, BUSINESS PRACTICES.

Owing to the prevailing interest in the present status of the cooperative retail stores, practically all of which are conducted for farmers and handle supplies for the farm, it was believed that the underlying principles of success and failure of these organizations should be ascertained, in order that the office could be in a position to state the facts relating to these enterprises. During the past fiscal year personal visits were made to 15 cooperative stores located in New York, New Jersey, Pennsylvania, and Virginia. A complete analysis of the business of these stores was made and a detailed history of the organizations obtained. As it was decided to extend this investigation during the fiscal year 1916, it is planned to make personal visits to cooperative stores located in the other sections of the United States, securing a complete analysis of the business of the stores visited from the time of their organization to the present day, ascertaining the reasons for success or failure, the benefits derived by the members, if any, and if possible to determine the exact status of the cooperative store in the United States to-day. In order that this movement may be looked upon in the light of the facts as to the past successes and failures, and the present economic position of these enterprises, it is necessary to make a complete study of these organizations.

#### STATE LAWS RELATING TO COMMISSION BUSINESS.

Investigations have been started relating to the commission laws recently passed in the States of Alabama, Colorado, Washington, and New York. These laws prescribe certain requirements of individuals and concerns engaged in handling agricultural products on a commission basis. The purpose of these investigations is to watch the operation and ascertain the effect of the requirements prescribed in these laws upon the business in general, and the effect as it relates to the producer and the consumer.

#### SURVEY OF THE BUSINESS OF COOPERATIVE CANNING OF FRUITS AND VEGETABLES.

In cooperation with the Bureau of Organization and Marketing of the Oregon State Agricultural College, a comprehensive survey of the business of canning fruits and vegetables cooperatively in the Pacific Northwest has been made. This survey covered the business of 21 canneries located in Washington, Oregon, and California. Over 80 per cent of the cooperative fruit and vegetable canneries in this territory have been complete failures. In order to determine the reasons for the great number of failures and the requirements



for success in the conducting of these enterprises a complete analysis of the entire business career was made of the 21 representative canneries. The information thus obtained shows clearly that the business of a cooperative cannery is ordinarily a hazardous one, and that there are certain fundamental requirements, such as the necessary amount of green goods, proper management, and sufficient capital, to make the organization a success. The material collected in this survey is available for those considering the establishment of a cannery.

Material was also secured from which a cost system of accounts for fruit and vegetable canneries is being prepared, the lack of proper accounting systems being one of the weakest points in these organizations. By securing a simple yet comprehensive and complete cost system of accounts which can be used by the smaller canneries generally, this business will be placed upon a much more stable basis and accurate statistics can be secured, the analysis of which will indicate changes necessary for the improvement of the business operations of these organizations.

#### MISCELLANEOUS ACTIVITIES.

An investigation was made of one of the oldest and most successful cooperative cheese-selling associations in the United States, as it was thought that a knowledge of the method of conducting this business would be of great value to the cooperative cheese factories throughout the United States. A plan was outlined for the organization of the hop growers in the States of Oregon, Washington, and Idaho into three State associations which are affiliated into a central selling association, this work being done by the field agent located at the Oregon State Agricultural College, working in cooperation with this office.

The aim of all the activities under Marketing Business Practice is to increase the business efficiency of individuals, cooperative organizations, and concerns engaged in the marketing, distributing, and storing of agricultural products. Any improvement in business methods means more economical conduct, resulting in smaller margins and better returns to producers and a lessening of costs to consumers.

The work of this project has been directed by Mr. W. H. Kerr, assisted by Messrs. G. A. Nahstoll, J. R. Humphrey, J. W. Boies, field agent, and Dr. Hector Macpherson, field agent, the last two being located in Oregon, in cooperation with the Oregon State Agricultural College.

#### MARKET SURVEYS, METHODS AND COSTS.

##### STUDY OF MARKET METHODS.

PROCEDURE.—During the summer and fall of 1914 surveys of marketing conditions were made in 23 important central and northern markets. A study was made of the machinery and marketing methods employed in each market to determine the usual and necessary number of handlings before farm products, especially perishables, reach the consumer. A special study was made of the methods of handling and marketing cantaloupes and apples.

The plan generally pursued was to station one market assistant in each city, who made a study of such items as the sources of supply, quantity and condition of arrivals, and the wholesale prices prevailing. After acquainting himself with general conditions, specific typical cars of fruits or vegetables were selected for detailed study. Careful tabulations were made of all ascertainable charges and costs accruing on these cars, including freight, refrigeration, selling charges, and transportation within the city. A record was made of the entire wholesale distribution of each. The product was then followed into the hands of the jobber and retailer, respectively, a record being made in each case of such items as the prices paid and received, the expense incurred for haulage and delivery, and losses through spoilage. In this way 91 cars were traced in part to the consumer. The largest proportion of any one car actually traced to the final purchaser was about 72 per cent. Frequently so many retailers participated in the distribution, and the product moved so quickly that it was practicable to obtain final prices on less than 5 per cent of the contents of the car.

RESULTS.—The results of this work have been used in part in the preparation of several publications dealing with the marketing of specific products or with specific phases of the marketing problem. Department Bulletins Nos. 266: Outlets and Methods of Sale for Shippers of Fruits and Vegetables, and 267: Methods of Wholesale Distribution of Fruits and Vegetables on Large Markets, are the direct results of this work. Comprehensive reports covering the conditions found at each market have been prepared and placed on file as guides in the selection of suitable fields for further and more detailed investigations. Experience has been gained which has been valuable in outlining the further development of this work.

#### STUDY OF SOUTHERN MARKETS.

In January and February, 1915, eight members of the force devoted a few weeks to an investigation of marketing conditions in nearly all of the larger cities in the Southern States east of Texas with especial reference to the possibility of their development as markets for products of diversified agriculture in the South. Reports were compiled and placed on file for use in outlining further work, although the investigations were not so detailed as to justify specific publications upon these markets.

#### ORIGIN AND COMMERCIAL MOVEMENT OF SPECIFIC CROPS.

CROPS SELECTED.—As a preliminary to experimental work to determine the usefulness, cost, and practicability of a market news service for perishable products, it was decided to locate in so far as possible all the areas of surplus production of specific perishable crops from which car-lot quantities moved to market. In deciding upon the crops to be studied, an effort was made to select those which would move in succession throughout the spring, summer, and fall months and which were produced in large quantity within certain well-defined areas. It was thought desirable that these areas of intense production be scattered as widely as possible over the United States.

These conditions were fulfilled by selecting strawberries, fresh tomatoes, cantaloupes, and peaches as the products for specific study.

PROCEDURE.—Basic information was secured by addressing every cooperative association in the country interested in the production and marketing of these products of which this office had record; by correspondence with railroad officials; and finally by securing from the local railroad agents or their superiors a detailed statement by points of origin of the actual number of carloads of each of these products shipped during the season of 1914. From the same sources of information were determined the periods within which car-lot quantities moved to market from each of the important areas of production.

RESULTS.—As a result of this survey, publications have been prepared and issued showing the supply and distribution of each of these products. These Department Bulletins are No. 237: Strawberry Supply and Distribution, 1914; No. 290: Rail Shipments and Distribution of Fresh Tomatoes, 1914; No. 298: Peach Supply and Distribution, 1914; and No. 315: Cantaloupe Marketing in the Larger Cities with Car-Lot Supply, 1914. Each contains maps and diagrams showing the agricultural and seasonal distribution of the crop by States and counties and a detailed tabulation of carload shipments by railroad stations from each State, with totals by distinct production areas and for the country as a whole. In connection with this work a compilation has been made of cooperative associations and other organizations interested in the shipment of these products, and a representative list of growers of each has been compiled who are so located as to represent the most important commercial areas of production in each case.

#### INVESTIGATIONAL AND EXPERIMENTAL MARKET-NEWS WORK.

PRELIMINARY WORK IN THE MARKETS.—With the information just described in hand, it was decided to begin the investigation with the distribution and sale of the Louisiana strawberry crop, and since the personnel and means at the command of the office would not permit it to place its own representatives in all of the important markets, some 20 of the larger northern and central markets were visited by such representatives, who made arrangements with the principal handlers of strawberries in each case to furnish to the office direct telegraphic reports each day of the quantities of strawberries received in these markets so far as this information could be ascertained, their sources of origin, and the wholesale prices prevailing. Arrangements were made that these reports be furnished in duplicate to our representative in the producing section and to the Washington office.

This system for securing market reports was modified and developed with the progress of the season as resources would allow. On July 1, 1915, the office had its own men, who were devoting full time to marketing work, stationed in New York, Buffalo, Baltimore, Chicago, St. Louis, and Kansas City, while it was represented by part-time employees, reporting directly to this office, in Albany, Cleveland, Detroit, Milwaukee, St. Paul, Sioux City, Omaha, Des Moines, and Columbus. At Boston, Pittsburgh, and Denver satisfactory arrangements with commercial houses were still in operation.



**ARRANGEMENTS WITH TRANSPORTATION COMPANIES.**—In order that the information on shipments might be accurate and complete this office secured the cooperation of practically every railroad and express company engaged in the transportation of these products. These carriers reported to the office by night telegram the number of cars of each product originating on their lines during the preceding 24 hours, with destinations. Diversions and reconsignments at important gateways were also secured. Arrangements were made by which the carriers delivering products at points where the office was represented by market reporters furnished these representatives with a daily statement of all receipts at those points.

**FIELD WORK IN PRODUCING SECTIONS.**—Work in the producing sections began in Louisiana during the latter part of March when the movement of the strawberry crop assumed important proportions. Our representative was kept informed of the number of cars moving each day with destinations and all diversions ordered. The Washington office kept him informed as to arrivals and prices prevailing in all markets. This information was made available to all growers, shippers, and associations by telephone communication from Hammond, La., and by public bulletins displayed at important shipping points. Support and cooperation was received from all of the producers and from nearly all of the shipping agencies. As a result of the work in Louisiana this office has secured a complete history of the distribution of the strawberry crop for the past season. This history shows exactly how many cars went to each market, the competition encountered therein, and the prices realized.

Similar experimental work to bring the news service within the reach of producers and to determine its practicability and usefulness to them was carried on at Crystal Springs, Miss., and Jacksonville, Tex., in connection with the movement of tomato crops from those sections; and in the Imperial Valley of California and at Mesa, Ariz., in connection with the movement of the cantaloupe crop. A modification of this system was tried out, with St. Louis as a basis of operation, in the marketing of the peach crop of Texas, Oklahoma, and Arkansas. The important peach-carrying railroads of that section cooperated effectively in distributing to their shippers all of the information at the disposal of the office. A similar experiment in connection with the marketing of northwestern peaches and pears from the Pacific coast States had its headquarters at North Yakima, Wash. Similar work was inaugurated at the proper time in connection with the marketing of the cantaloupe crop at Rockyford, Colo.

**BENEFITS TO PRODUCERS.**—Letters have been received from every producing section where these experiments have been tried indicating that distribution has been improved; that glutted markets have been prevented to some extent; that total shipments from several districts have been greater than they would have been without this service; and that large bodies of growers have been given accurate and disinterested information concerning conditions prevailing in important distant markets.

**FIELD AND INFORMATIVE WORK IN THE MARKETS.**—The placing of permanent employees of this office in several of the larger markets has made this experiment of value to those actively engaged in the wholesale handling and distribution of the perishable products re-

ported. Heretofore even the best-informed dealers have not been able to obtain such accurate and comprehensive reports of shipments originating in all districts, of supplies destined to their own markets, of the quantities on hand in competing markets, of markets furnishing a possible outlet for their own surplus, or of prevailing market conditions at so large a number of points. This fact has secured for the representatives of the office the enthusiastic cooperation of a majority of the wholesale dealers, commission merchants, and others in all markets where our men are located, notably in New York, Chicago, and St. Louis.

During the latter part of the season a mail summary was furnished by the Washington office to approximately 710 persons, while several hundred more were prepared and mailed from temporary offices at St. Louis, Rocky Ford, Colo., and North Yakima, Wash., largely to producers and shippers whose operation would not justify the expense of telegraphic reports.

TELEGRAPHIC ARRANGEMENTS.—It has been found that the services of four telegraphers are needed for the expeditious handling of this experimental service in its present size. Both the Western Union and Postal Telegraph Cos. have installed direct wires in this office, and arrangements are made by which our operators connect by direct wire and without relay with both Chicago and St. Louis. Methods of handling and checking this information have been so worked out that the percentage of error has been reduced to a minimum. The great length of many of these telegrams and the knowledge that they will be ready for transmission at a given hour each day enables the office to secure the very best telegraphic service, so that information is assembled in Washington from all parts of the country and rewired to our representatives at distant points more quickly than they could assemble and digest the information if they received it direct from its various sources.

Owing to the difference in time between the eastern and western markets and the different hours at which sales are most active, it has been demonstrated that the most efficient service will require either that a greater number of reports be issued from this office to cover the various sections of the country or that the information must be handled directly through branch offices so located as to be convenient clearing houses for those cities whose markets are active at the same hours.

CHARACTER OF THE WORK.—Each of the activities conducted under this project has been in a new field and there have been no precedents to follow. Underlying principles have been worked out and conclusions reached as to what is possible and practicable in the determination of distribution costs and of the consuming capacity of markets, and the foundations have been laid upon which a permanent, comprehensive, and efficient market-news service can be built.

This project is conducted under the leadership of Mr. Wells A. Sherman, assisted by Messrs. James H. Collins, Carroll W. Dunning, John W. Fisher, jr., Paul Froehlich, A. D. Gail, jr., John C. Gilbert, Phil C. Isbell, James P. Klein, L. H. Martin, J. W. Park, R. Maynard Peterson, O. W. Schleussner, and Houston F. Walker.

## MARKET GRADES AND STANDARDS.

The work under this project has been developed toward its recognized object—to encourage and educate growers and shippers properly to prepare their products for markets and to show them the vital need of fixed grades and standards for universal use, with a view to ultimate national standardization of market grades, weights, measures, and packages or containers. To this end the following lines of work have been prosecuted:

## GRADING, PACKING, AND HANDLING INVESTIGATIONS.

During the year special attention was given the study of the various methods used at present in the different States in picking, grading, packing, and handling a number of perishable crops, especially cantaloupes, strawberries, tomatoes, peaches, and potatoes. The field investigations connected with these crops were pursued in 20 States. These studies were not completed during the fiscal year 1915, but will be continued during the year 1916 and extended to other crops. A special study was made in the States of Florida, Georgia, Louisiana, and Mississippi of the problems which growers and shippers of the Southern States must meet in the marketing of their diversified crops. This problem appears to be largely a question of proper grading and preparation to meet the requirements of their markets.

## STUDY OF PACKAGES OR CONTAINERS FOR FRUITS AND VEGETABLES.

The investigations of the handling of various crops include the study of the packages and containers used. It is found that in connection with almost every commodity a very large number of types, shapes, and sizes of containers are in use in the various States. It is believed not only that many of these types are unnecessary and undesirable, but that the standardization of types and sizes is greatly needed. Data are being secured from the several hundred factories which make fruit and truck packages concerning the types, specifications, capacity, and cost of these containers. This information is available for use in connection with the legislation which growers, shippers, dealers, and package manufacturers are working for looking toward the standardization of fruit and truck packages. The office collection of these containers for examination, testing, and demonstration, now amounting to over 200 different types and sizes, is growing constantly.

## MISCELLANEOUS ACTIVITIES.

Large shippers' and growers' cooperative marketing associations were asked to furnish this office with reports of the standards of quality, type, and capacity of packages, grading rules, methods and systems of inspection, and labels used by them. This information, contained in over 400 replies, has been classified, indexed, and filed, and in connection with the other material and data collected, is proving of great value.



This office furnished information to the Boston Chamber of Commerce to be used in preparing a bill on the grading, packing, and marking of barrels of apples. This bill has been passed in Vermont, Massachusetts, and Connecticut, and is pending in New Hampshire and Rhode Island.

Office of the Secretary, Circular No. 48: Marketing Maine Potatoes, prepared by workers under this project, deals with the need for better methods of handling and preparing potatoes for market, and a Farmers' Bulletin, entitled The Commercial Grading, Packing, and Shipping of Cantaloupes, has been submitted. Mr. C. T. More, who is in charge of this work, has cooperated informally with the Bureau of Standards. Mr. M. M. Stewart has assisted in this project during 1915.

#### TRANSPORTATION AND STORAGE.

Several of the lines of work reported last year have been continued. After completing the study of the demurrage laws and regulations of the various States, Department Bulletin No. 191, Demurrage Information for Farmers, was published. The investigation of the transportation of milk, made in cooperation with the Boston Chamber of Commerce, has been continued and an exhaustive report on the subject has been issued by that organization. An article entitled Concentrating and Storage-in-Transit Arrangements in Transporting Farm Products was published in the Agricultural Outlook, Farmers' Bulletin No. 672.

No opportunity has been lost to place before railroad officials the general policy and work of the office and of soliciting their cooperation and assistance in every way. This cooperation is very necessary and of great importance in view of the fact that transportation is so inseparably connected with every phase of the marketing question. Conferences have been held with shippers and representatives of carriers, securing all possible data on such items as equipment, terminal facilities, routing, refrigeration, and time in transit.

Mr. G. C. White is in charge of this work, assisted by Mr. T. F. Powell.

#### STUDY OF LOSS OF FOODSTUFFS IN TRANSIT.

With a view to determining the causes of the enormous loss of foodstuffs between the producer and the consumer for the information of producers and shippers, and with the intention of working out a method whereby much of it can be prevented, work was begun in February, in cooperation with the freight claim agents of the different common carriers of the country and with the aid of various freight claim associations. Substantial progress has been made in this work, but results are not yet ready for publication.

#### STUDY OF SOUTHERN TRANSPORTATION CONDITIONS.

In connection with the department's studies of crop diversification in the South reports have been secured from the railroads serving Atlanta, Birmingham, Savannah, and Columbia of the quantity of certain commodities which they ship from distant sections that could be produced in neighboring localities. Business men and others

interested were assisted at conferences held with railroad officials and the South Carolina railroad commission in securing adjustments of the intrastate grain rates and of the outbound interstate rates on grain. Certain phases of the transportation of dairy products in North Carolina have been investigated in conjunction with the project Marketing Dairy Products.

#### STORAGE.

The question of storage has been dealt with incidentally in connection with transportation problems and a detailed study has been made, under the direction of Mr. C. W. Moomaw, of the storage of apples.

This work began in July, 1914, with a study of commercial crop and market prospects. Reports were secured from a large number of organizations throughout the country, and on the eve of the crop movement information and definite suggestions were published through the Office of Information and the Agricultural Outlook, Farmers' Bulletin No. 620, page 16, Marketing the Apple Crop.

Early in the winter of 1914-15 inquiries were addressed to horticultural societies and others in the apple trade and to all cold-storage firms whose addresses could be secured to determine which of these storages were engaged in the storage of apples. As soon as this list was compiled their cooperation was requested in an effort to make public through monthly reports transmitted to this office the movement into consumption of apples held by these firms.

Each of the reporting cold storage companies made a statement as of December 1 of the number of barrels and number of boxes of apples then held, and on the first of each month thereafter a statement was given of the number of barrels and the number of boxes of apples remaining on hand, the number which had been withdrawn during the preceding month, and the corresponding figures for the year 1912, when the country as a whole had a commercial apple crop comparable with that of 1914.

These reports made it possible to issue percentage figures showing the rate at which the apples in cold storage were being consumed, and the public was thus advised throughout the season of the proportion of the crop originally placed in storage which still remained to be consumed. These figures were made public through the Office of Information, through the Agricultural Outlook, and were sent by mail to all of the cold storages holding apples, to selected lists of growers and dealers, and to any others upon request. The work was regarded with some indifference by commercial interests whose own sources of information were well organized, but was greeted with satisfaction by a large number of persons interested in the industry, and the demand for the information increased steadily while the work was in progress from January until June, 1915. The total number of cold storages which furnished information during this investigation was 444.

During the fall and early winter an investigation of special phases of apple marketing was conducted in the producing districts of New York and in the markets of New York City, Chicago, St. Louis, Louisville, Kansas City, St. Paul, Detroit, and Cincinnati. The

phases studied were the relation of prices to receipts; grades and standards; the presence and effect of poor-grade apples upon market conditions; wholesale, jobbing, and retail methods and costs; and export-market conditions in Europe and South America.

Department Bulletin 302, Apple Market Investigations, 1914-15, was published as a result of these studies.

#### CITY MARKETING AND DISTRIBUTION.

##### SERVICE WORK FOR CITIES.

Surveys of marketing conditions, varying in extent and comprehensiveness, have been made in the following six cities: Rochester, N. Y.; Huntington, W. Va.; Parkersburg, W. Va.; Jersey City, N. J.; Hartford, Conn.; and Lynchburg, Va. Following surveys in 1914, advisory work has been continued in Providence, R. I. In addition, a heavy correspondence has developed with other cities that desire guidance in solving their market difficulties. All of these cities are interested in establishing municipal marketing enterprises, either wholesale or retail. Following the personal surveys, reports in most cases have been made to the various municipalities containing an outline of their existing marketing facilities, the apparent weaknesses, and recommendations for improvements.

##### STUDIES OF MUNICIPALLY OWNED MARKET BUILDINGS AND MARKET PLACES.

The investigational work carried on during the past year, as in 1914, has had to do largely with municipal wholesale and retail public markets, farmers' markets, and terminal-market projects. Personal observations of desirable features and of defects in municipal and privately owned public markets have been made in 14 cities: Cleveland; Detroit; New Orleans; Kansas City; Denver; New York City; Dubuque and Des Moines, Iowa; Madison, Wis.; Norfolk, Portsmouth, and Richmond, Va.; Newark and Paterson, N. J. Unsuccessful markets, as well as those which are giving fine service, have been visited in order to study intelligently the factors which have to do with the problem of establishing efficient municipal marketing projects. It has been found that where municipal markets have failed, it has been due in practically every case to faulty location, lack of reasonably good business management, or unattractive and insanitary conditions. The investigations made so far indicate that, if given a fair chance to succeed, municipally owned wholesale and retail markets will prove of great value in promoting efficiency and economy in the distribution and marketing of farm products in cities of substantial size. The results of a certain amount of the investigational work done on municipal marketing enterprises were incorporated in an article entitled, Retail Public Markets, published in the 1914 Yearbook of the Department of Agriculture. It is also available in pamphlet form as Yearbook Separate No. 636.

Shortly before the close of the fiscal year 1915, a complete survey of municipal marketing activity in the United States was begun and is now well under way.



## STUDIES OF TERMINAL-MARKET PROJECTS.

Much interest in the development of modern terminal markets is apparent in several of the larger cities. These movements are being observed closely and the tentative plans studied so that the office may be placed in position to guide other cities in this important phase of city distribution.

Mr. G. V. Branch is in charge of this work, with Miss Achsah Lippincott as assistant.

## MARKETING BY PARCEL POST AND EXPRESS.

The work done under this project has been pursued along the same lines as shown in the last report, with such minor variations as have been necessitated from time to time by circumstances. Experimental shipments during the year have consisted of the following commodities: Oranges, grapefruit, pineapples, strawberries, huckleberries, blackberries, raspberries, gooseberries, grapes, cherries, cantaloupes, plums, pears, peaches, apples, lettuce, milk, butter, eggs, cane sirup, maple sirup, maple sugar, and assorted vegetables. In nearly every case the success of the shipment depends upon the judgment used in regard to the quality of the fruit shipped and the type of container. Special suggestions are given in a manuscript which has been submitted for a Farmers' Bulletin, entitled Suggestions for Parcel-Post Marketing.

## EXPERIMENTS IN SHIPPING.

Two hundred and twelve parcels, about 800 pounds, of lettuce produced by the Arlington Farm of this department, were shipped to various parts of the country with a satisfactory degree of success. The wetting down which some shippers of lettuce insist is necessary has been found to be undesirable, as it produces considerable soft rot and more loss than when the lettuce is shipped dry or practically dry. When thus shipped wilting results, but this is readily overcome by placing the lettuce in cold water when it is received. There is apparently good reason to believe that a successful and profitable distribution of lettuce can be made to retailers who handle but small quantities, such as 10, 20, or 30 pounds.

Twenty-six boxes of oranges and 143 boxes of grapefruit have been shipped experimentally. For distances in which shipments of such fruits can be made economically the usual commercial crate may be used. Twenty-six shipments of pineapples were made. This fruit is easily bruised and requires care in packing, so that the handling it will receive will not cause undue injury. It is apparent from the retail prices prevailing in many parts of the country that the distribution of this fruit in such quantities as consumers might desire could be made economically from central distributing points, where they are received in car lots by fast freight.

An effort was made during the strawberry season of 1915 to handle a sufficient quantity of strawberries so that fairly satisfactory conclusions might be reached. Two hundred and forty crates were handled, 122 by express and 118 by parcel post. Apparently the chief problem to be solved (as is true with the handling of all berries and small fruits by parcel post) was the devising of some means

whereby crates with tight bottoms, as required by the present postal regulations, might be eliminated. To secure the necessary data ordinary commercial crates of different sizes were used. They were provided with heavy absorbent pads of unsaturated roofing felt. The results indicate that there is no reason why ordinary commercial crates otherwise permissible under the postal regulations should not be used without even these absorbent pads when weighing over 20 pounds, as they are handled outside of mail sacks entirely. Small parcels of berries weighing less than 20 pounds may require the absorbent pad, but even in this case it is hardly necessary if the berries are picked and forwarded in a proper shipping condition.

#### FIELD STUDIES.

Two definite field studies have been conducted for the purpose of ascertaining the possibilities of direct marketing from producer to consumer. Conditions were not found to be favorable for the present inauguration of such marketing, but the need of an educational campaign was evident. Other incidental field work has been conducted in connection with the accumulation of information in regard to economic conditions on the farm as related to direct marketing. Close cooperation has been maintained with the Post Office Department in all of this work, which is under the direction of Mr. L. B. Flohr, assisted by Messrs. J. W. Law, C. A. Burmeister, and C. C. Hawbaker.

#### COTTON HANDLING AND MARKETING.

The various lines of work reported under this project last year which have developed into separate projects are reported upon separately this year. Work remaining under this head is developed along two lines.

#### SURVEY OF PRIMARY MARKETS.

A comprehensive survey of the Texas and Oklahoma primary cotton markets was conducted during the year to determine the proportions of the different grades, colors, and staple lengths produced in the western part of the belt; to determine the relation between quality and price in the same market in order to draw a comparison between different markets and between primary markets and the ports; to estimate the effect of the present abnormal condition on this section and to discover the actual conditions under which the western farmer disposed of his product. This investigation was conducted through the services of about 30 temporary cotton samplers, in as many different markets, each of whom sampled during each week from 25 to 50 bales of cotton, and obtained a record of the name of the seller, date of sale, and price of each bale sampled. In this way approximately 17,000 samples were obtained; these are now being classed in Washington and data are being compiled and prepared for report.

#### COOPERATIVE HANDLING AND MARKETING OF COTTON.

At Scott, Ark., the Scott Cotton Growers' Association, formed with the assistance of this office, as described in the annual report for 1914, secured the services of men experienced in the cotton business

and during the past fiscal year has received help in an advisory way. This expert and the president of the association were sent East to arrange for the direct sale of cotton to mills and mill brokers, and upon their request a representative of this office accompanied them. By this personal presentation of the work of the association, business connections were made with cotton mills or mill brokers at Charlotte, N. C.; Fall River, Mass.; Providence, R. I.; and Montreal, Canada.

The first cooperative work of this office, then the Office of Markets, was started at Atkins, Ark., and the largest measure of success has been accomplished at this point. The association has purchased and is operating a 4-stand gin and has built a fireproof warehouse with a capacity of 2,000 bales. This warehouse was built by the labor of the farmers, so that the only expense charged to the funds of the association was for corrugated iron sheathing. This association has secured more than the local price on both cotton and cottonseed.

Subsequently, the work of this office in Arkansas was centralized at Little Rock. Here, in connection with grading studies, samples from 10,573 bales from 45 different points received attention. The statistics for this work are now being compiled, and while comparative prices are not yet on file it is evident that cooperative efforts in this line are meeting with financial success, and that increased prices must follow when better varieties are planted, when the cotton in ginned with greater care, when it is sold in even-running lots, and when mixed packed bales and plated bales are eliminated.

Continuing the grading studies and working in cooperation with the North Carolina Agricultural College and Experiment Station, a representative from this office was stationed at Tarboro, N. C., from October 2, 1914, to February 5, 1915. The ginners of the county mailed to this representative a sample of each bale ginned, with proper identification as to the gin number and owner's name and address. These samples were classed immediately and notice regarding the classification was mailed to the owner, with the request that information covering date of sale, price obtained, and whether sold for cash or in trade be furnished in return. Thus the farmers of Edgecombe County were furnished with the grade and approximate staple of 10,620 bales of cotton.

As a check on this work, 3,300 samples were collected in neighboring counties having similar soil and climatic conditions, where the producer was not informed as to the class of his cotton before making sale. These samples have accompanying slips giving date of sale and price received. Upon the compilation of all data covering this work much valuable information should be available concerning the benefit to the producer of knowing the class of his cotton before making sale and concerning the advantages of cooperation.

A committee on cotton culture in the southwest was organized in the Bureau of Plant Industry in 1910 for the purpose of aiding in the establishment of a cotton industry in Arizona and California and of encouraging its continuance. With the increase of production the question of handling and marketing the crop has become important and the committee has become an inter-bureau committee, this office being interested in the latter phases of the subject. In this connection further study of the standardization of Arizona-Egyptian cotton was made, an expert from this office classing the



cotton produced by the Salt River Valley Cotton Growers' Association, samples being assembled at Tempe from Chandler, Mesa, and Glendale. Besides the classing of 5,000 bales for this association assistance and advice was given in the picking, ginning, and marketing of the cotton. The report of these activities has been submitted for publication in Department Bulletin No. 311: The Handling and Marketing of the Arizona-Egyptian Cotton of the Salt River Valley.

As representatives of the committee on southwestern cotton culture of the department a member of the staff of this office, and an expert of the Bureau of Plant Industry, were sent to England and the Continent in connection with an investigation into the spinning of the finer grades of Egyptian and other staple cotton, with special reference to such cottons produced by organized communities in the United States with a view to determining the present markets for these staples as a basis for informing the producers concerning the discriminations made by the consumers so that they might be fully and directly informed in these matters. Copies of the five tentative grades for the Arizona-Egyptian cotton crop were forwarded to Europe, and the manager of the Central Association of Cotton Growers at Mesa, Ariz., accompanied the department's representatives to display these grades before the cotton exchanges, merchants, and spinners of England and the Continent.

The work of this project has been conducted by Messrs. Fred Taylor, W. R. Meadows, D. C. Griffith, J. G. Martin, C. J. McConnell, C. F. Creswell, and L. W. Kellner.

#### COTTON WAREHOUSE INVESTIGATIONS.

During the latter part of the fiscal year 1914 work in cotton-warehouse investigations was begun, in connection with the project Cotton Handling and Marketing. This work was under the direct supervision of the chief, but was performed by Mr. R. L. Nixon, assisted during the latter part of the year by Mr. R. L. Newton.

OBJECTS.—When the work was first undertaken an attempt was made to secure a complete list of all cotton storage houses in the States of Georgia and North Carolina. Since the work has been completed in these States, it has been extended gradually to the other States in the cotton belt. While the warehouse list is not yet complete, there has been compiled a list of 4,227 cotton storage and compress companies. Efforts have been made to secure complete data in regard to the total storage capacity of all the warehouses, especially in Georgia and North Carolina, the customary charges for storage, the rate of insurance on cotton stored in these buildings, the location of the warehouses now in use, with reference to production and to shipping centers, and other factors affecting cotton in storage. Much useful information was collected, some of which has been tabulated and published.

PROCEDURE.—The work was conducted first by correspondence, then by visiting a large number of representative warehouses and conferring personally with warehousemen, cotton dealers, State officials, farmers, and others interested in the economical handling and marketing of cotton. Special efforts were made to determine the economic importance of the warehouse in handling cotton, and especially in protecting it from fire and country damage. Efforts were

also made to determine on what conditions banks advanced money on cotton warehouse receipts.

In all of this work the purpose has been to draw a careful distinction between the companies that furnished a satisfactory service and those that did not, special efforts being made to determine why certain companies rendered efficient service while others failed. Careful studies have been made of the different types of warehouses now in use, especially those recognized as "standard" by the fire insurance underwriters' associations. These classes of buildings have been studied with reference to cost of construction compared with storage capacity, insurance rates charged on cotton stored in the different classes, and the adaptability and convenience of the different types with reference to handling cotton.

Questionnaires have been sent to all cotton mills asking for information in regard to the storage capacity, insurance rates, class, and construction of buildings used for storage, and the purpose for which the storage house is used—whether public, private, or both.

Many of the data gathered so far have been tabulated and published with conclusions in Department Bulletin 216: Cotton Warehouses; Storage Facilities Now Available in the South; and in Department Bulletin 277: Cotton Warehouse Construction.

#### MARKETING COTTON SEED AND ITS PRODUCTS.

Studies and investigations under this project are conducted primarily to determine the factors which influence or control the prices paid for cotton seed and its products, the advantages to be secured by producers through marketing cotton seed cooperatively or through cooperative cotton-oil mills, and the uses to which the cottonseed crop and its products are devoted. The work was begun in October, 1914, and has been conducted by Mr. H. T. Poe, jr.

The geographical location of all cottonseed-oil mills in the United States has been determined, existing rules relating to the grading, buying, and selling of cottonseed and its products have been compiled, compared, and studied with a view to working out a uniform set of rules for grades and grading, and assistance was rendered one of the State cottonseed crushers' associations in promulgating grading rules for buying and selling cotton seed. Copies of State laws regarding the taxing, branding, guaranteeing, sampling, and inspection of cottonseed products as foodstuffs have been secured, and recent State legislation relating to the cottonseed industry has been collected. A preliminary study has been made of the containers used in marketing cottonseed and in methods of handling, and new and improved machinery and processes examined and studied.

#### MOISTURE DETERMINATION AND ANALYSIS.

Moisture determinations were secured through the cooperation of the chemists of several cottonseed-oil mills on 3,623 carloads of cotton seed marketed from the crop year of 1914 in the States of Arkansas, Georgia, Tennessee, and Mississippi. Over 12,000 complete analyses of cotton seed grown during that season from points in all parts of the cotton belt have been collected. These analyses

show the percentage of meats, lint, oil, ammonia, and moisture content in the seed. Forty-five thousand analyses of seed grown during the past six years have been collected. These analyses were compiled and the average amount of moisture contained in cotton seed was determined. Whenever possible, it has been pointed out to those interested in buying and selling cotton seed that the moisture content may be determined quickly, accurately, and cheaply at the cottonseed-oil mill, and that cotton seed should be graded and stored on the moisture-content basis, as this principally determines its keeping qualities.

#### STUDY OF COOPERATIVE OIL MILLS.

A number of cooperative oil mills have been visited and studies have been made of their organization and operation. In this connection a study also was made of a cooperative compress company and of a cooperative marketing association connected with a cooperative oil mill. From these investigations, it has been found that certain cooperative cottonseed-oil mills properly organized and conducted have netted the farmers about 25 per cent more for their seed than they could have obtained in the open market.

#### USES OF COTTONSEED PRODUCTS.

One hundred and twenty-four uses have been found for cottonseed products and by-products, and a chart has been drafted showing their derivation. For other than culinary purposes the by-products of cottonseed oil are used extensively for soap and washing powders, and, to some extent, for making such commodities as putty, candles, insulating material, paint, composition roofing, linoleum, and artificial leather. It is found that the process of manufacturing vegetable lard from hydrogenated cottonseed oil has been greatly improved and its market has been extended. Cottonseed meal is used principally as a cattle feed and for fertilizing purposes. Linters and cottonseed-hull fiber are now being used to a great extent in the preparation of cellulose, from which pyroxylin is manufactured. Pyroxylin is used in the manufacture of celluloid, collodion, varnishes, artificial silk, moving picture films, etc.

Cellulose is also made into guncotton or nitrocellulose, and is the base of the different kinds of smokeless powder, cordite, and other high explosives. Questionnaires were sent to manufacturers of explosives for the purpose of determining more definitely the extent to which linters are now being used for this purpose. While the returns are not yet complete they indicate, as do available figures of the Bureau of the Census, that the supply of linters for the present season has not yet been exhausted. This may be taken as presumptive evidence that the reports to the effect that several millions of bales of cotton of good staple would be used this year for the manufacture of propulsive ammunition are much exaggerated.

#### MARKETING LIVE STOCK, MEATS, AND ANIMAL BY-PRODUCTS.

This work became a separate project at the beginning of this fiscal year, it having been reported last year under the general heading of Marketing Animal Products.



## TRACING SHIPMENTS OF CATTLE.

Investigations relative to methods and cost of marketing live stock and of marketing and distributing meat products and by-products occupied the first half of the fiscal year. As a basis both for a special report and for further investigations, typical shipments of cattle were traced from various sections of the country to the more prominent stockyard centers, itemized accounts being obtained of the various transactions involved, including the wholesale and retail distribution of the beef and its by-products. In this manner 12 lots of beef cattle were followed from points in Oregon, Montana, Kansas, Texas, Alabama, Illinois, and Virginia to the open markets at Portland (Oreg.), Fort Worth, Kansas City, East St. Louis, Chicago, and Baltimore. Representative carcasses of each lot were traced to their destination, the principal shipments having gone to Portland (Oreg.), Seattle, Indianapolis, Fort Wayne, Detroit, Cleveland, Buffalo, Jersey City, New York, Brooklyn, Providence, Boston, and a number of smaller eastern cities. They ultimately were sold to family, hotel, restaurant, and dining-car trade. Methods and costs of dressing and handling beef by small local butchers and packers also have been investigated by means of slaughter and retail cutting tests at seven cities and towns in seven widely distributed States. The results of these tests, together with a large amount of additional information pertaining to the shipment, handling, sale, and slaughter of meat animals and the wholesale distribution and retailing of meats, were tabulated early in the calendar year 1915 and were made available for the use of the Committee on the Economics of the Meat Situation appointed by the Secretary of Agriculture.

## STUDY OF CENTRALIZED LIVE-STOCK MARKETS.

A directory and descriptive file of all centralized live-stock markets in the United States is being compiled. The investigations which resulted in this directory involved a detailed study of the equipment, charges, selling agencies, dealers, buyers, slaughtering establishments, number and character of receipts and shipments, sources of live-stock supply and destination of live animals, beef products and by-products shipped from each of the 30 live-stock centers, extending from Boston to Portland (Oreg.) and from South St. Paul to New Orleans. Approximately half the live stock marketed in the United States passes through these central stockyard points; and this investigation is designed to furnish a basis for the determination of equitable charges and reasonable regulations necessary to insure the most efficient service to the public at such markets.

## STUDY OF COOPERATIVE LIVE-STOCK SHIPPING ASSOCIATIONS.

A field study of car-lot stock-shipping associations in the Northwest has been made, and shipments of some of the more successful associations have been personally accompanied to the South St. Paul, Chicago, and Buffalo markets to observe the methods used. Material has been collected concerning the organization and methods of these associations, for the information and aid of other com-

munities. A survey of the movement shows that over 500 associations are now shipping stock to market in a cooperative way, principally in Minnesota, Wisconsin, and Nebraska; also in Iowa, the Dakotas, Kansas, Michigan, Illinois, Indiana, and Ohio.

#### STUDY OF MUNICIPAL ABATTOIRS.

A survey of existing municipal abattoirs in their relation to the local marketing of live stock has been begun, including a first-hand study of typical instances and a comprehensive inquiry addressed to State and city officials throughout the country. Of the five municipally owned abattoirs in the United States, three have been studied personally. At 14 cities centralized abattoirs under private ownership with municipal inspection and control have been found, 13 of which are located in the Southern States. Municipally owned abattoirs are projected at nine other places at least, and the movement is extending rapidly. A publication calling attention to the limitations as well as the possibilities of these establishments as factors in locating marketing is in course of preparation.

#### STUDY OF COOPERATIVE MEAT-PACKING COMPANIES.

The rapid development of the cooperative packing-house movement within the past year, particularly in Wisconsin, Minnesota, and Iowa, prompted an investigation of local conditions and factors concerning this method of marketing. It was found that the so-called cooperative companies were being promoted almost wholly by parties from outside the communities concerned and without sufficient regard to the limitations which characterize this complex form of co-operation. The conclusions were issued as a press bulletin which called attention to the precautions essential to the success of such an enterprise. This was circulated particularly in about 25 communities in which cooperative packing plants are being projected.

#### LIVE-STOCK AND MEAT-MARKET REPORTS.

The methods, sources, accuracy, and use of market reports and the variations in prices of live stock, meats, and animal by-products at market centers have been investigated by means of personal inquiries and statistical compilations. The results of the investigation emphasize the urgent need of more reliable, complete, and uniform quotations, both of live stock and of wholesale and retail meat; and the compilation of variations in prices affords a valuable basis for further investigations as to the most favorable seasons for marketing the different classes of live stock and as to the normal seasonal fluctuations in market prices of meat products and by-products.

#### OTHER INVESTIGATIONS.

A schedule of 36 questions on marketing live stock has been addressed to 10,500 live-stock correspondents and price reporters of the Bureau of Crop Estimates in order to secure data from stockmen regarding the marketing problems which they consider most pressing. Returns from this inquiry will serve as a guide in the planning of

different subprojects, and should furnish other useful data. Preliminary studies of the marketing of farm-prepared meats have been made and a comprehensive survey begun, with a view to ascertaining the conditions and methods that have proved most favorable to this plan of marketing in the various States. A plan has been devised for estimating the number of feeding cattle and lambs in producing sections, the purpose being to aid in distributing the marketing of such stock more evenly and to bring producer and feeder into closer contact. Field investigations have been conducted preparatory to the inauguration of the plan during the coming stock-shipping season, and it is proposed also to include as soon as practicable the reporting of the number of fat stock destined for shipment from feed lots and grazing districts. Aid has been given in connection with marketing problems in various States, including Colorado, Wyoming, South Carolina, and Louisiana. An extensive survey has been made of live-stock marketing conditions in Colorado and Wyoming, and arrangements have been made for the placing of a live-stock marketing specialist in Louisiana. A cumulative information file, devoted to the marketing of live stock, meats, and their by-products, and related topics, was established at the beginning of the fiscal year to be maintained as a continuous feature of this work; also a card directory of stock growers, feeders, dealers, corporations, officials, and others concerned with the various phases of the subject.

The work of this project is under the immediate charge of Mr. L. D. Hall, assisted by Messrs. F. M. Simpson, S. W. Doty, Gilbert Gusler, and J. A. Rice.

#### MARKETING DAIRY PRODUCTS.

The principal work under this project was devoted to the marketing of butter. The office now has in its files tabulations, photographs, and illustrative statistical charts on many phases of the butter market. Special attention has been given to the question of costs, to market grades and standards established by the organizations of the wholesale trade, and the various rules of the butter and egg committees of these organizations.

#### COOPERATIVE INVESTIGATIONS.

Under the cooperative arrangements with the University of Minnesota, the State dairy and food commission of that State, and the Dairy Division of the Bureau of Animal Industry, over 500 farmers' creameries, located in different parts of every county in the State, were visited and other creameries were reached by means of a questionnaire. From a total of 634 reports, detailed information regarding their organizations, methods and costs of collecting cream for manufacture into butter, methods of preparing butter for the markets, and selling agreements under which the butter is marketed was compiled and is now in form for analysis.

Contemporaneously with these investigations some of the large centralizing creameries operating in Minnesota were also visited, and information along the following lines was obtained from 15: Costs of obtaining cream by different systems of buying; prices paid for



cream of different grades and from different geographical areas; influence of competing buying agencies, such as farmers' local creameries, upon the prices paid to the farmers; cost of manufacturing butter at different seasons in different-sized plants; and description of different selling arrangements and methods of preparing butter for the market. These data are ready to be tabulated, together with supplemental information concerning advertising and selling methods and prices received for the butter by these creameries in the different States where representatives of this division of the office are working.

Other detailed studies conducted under cooperative agreements with the College of Agriculture and the Agricultural Experiment Station of the University of Wisconsin have yielded much information regarding many different phases of the marketing of butter.

In addition to this work, and directly related to the investigations carried on in the States of Minnesota and Wisconsin, data were obtained by representatives of this office from the wholesale and retail butter dealers of Minneapolis, St. Paul, Duluth, Chicago, Buffalo, Elgin, New York, Philadelphia, and all the leading cities of the Southern States.

#### STUDY OF SHRINKAGE.

During the latter part of the year investigations of the shrinkage of butter from the churn to the market were begun. This work is being continued in cooperation with the dairy and food commission of Minnesota, the Bureau of Chemistry, and the Dairy Division of the Bureau of Animal Industry of the Department of Agriculture.

#### STUDY OF SOUTHERN MARKETS.

A general survey of dairy markets in the Southern States was made during the months of January and February, 1915. From the information obtained it was evident that many of the creameries in those States were in need of assistance in marketing their surplus butter during the summer months. Accordingly, all the largest cities in the South and many of the creameries have been visited in order to collect such data as are necessary to give information to the southern creameries regarding the best way of marketing their butter and avoiding the accumulation of a large surplus.

#### MILK INVESTIGATIONS.

As a result of the cooperative arrangements with the Massachusetts Agricultural College investigations of the cost of distributing special and ordinary milk were made in the towns of Walpole, Amherst, Haverhill, Pittsfield, Springfield, and Worcester. Approximately 200 distributors were interviewed and complete reports obtained from 75 of them. Information based on these reports will be made available to the public.

The work under this project was initiated by Mr. J. A. Vye and is now in charge of Mr. Roy C. Potts assisted by Messrs. G. P. Warber, H. F. Meyer, and representatives of the cooperating organizations.

## GRAIN MARKETING.

Preliminary work on this subject was developed in connection with the project Marketing Business Practice. Near the close of the fiscal year, however, a separate project was drawn up for this work, and investigators were appointed to devote their entire time to the subject.

An investigation was conducted in the State of Kansas and in Kansas City, Mo., during the summer of 1914 in response to House Resolution No. 571. A report of this investigation was published as House of Representatives Document No. 1271: Prices of Wheat to Producers in Kansas, etc.

A special investigation was made in the States of North Carolina, South Carolina, and Georgia with respect to marketing conditions for the purpose of ascertaining the requirements for handling the increased crop of grains and hay due to the decrease in cotton acreage. From this investigation material was secured which was used in making recommendations to organizations and farmers generally throughout the Southern States.

Investigations of the marketing of grain and hay at country points and terminal markets are now in progress. It is planned to begin as soon as practicable an investigation of the methods of distribution of grain, grain products, and hay to the consumer in the Eastern and South Atlantic States.

## RURAL-ORGANIZATION INVESTIGATIONS.

## RURAL CREDIT, INSURANCE, AND COMMUNICATION.

## RURAL CREDIT.

Data with regard to prevailing interest rates on farm-mortgage loans and on short-time loans to farmers (with personal or collateral security) have been received from banks, from special correspondents, from representative farmers in the several States, and from the county and local correspondents of the Bureau of Crop Estimates. Averages have been computed, by States, for the reports from each source, and, in addition, the reports from the farmers have been tabulated in such form as to show, for each State and for districts within the State, the number of reports, giving each individual interest rate. On the basis of this tabulation, colored charts (bar diagrams) have been constructed, showing, by States, the relative number of reports, giving each rate.

Likewise much information has been secured relative to the important question of commissions on farm-mortgage loans, and figures have been compiled representing in general the commission rates prevailing in the several States, and the total cost of farm-mortgage loans for interest and commission together. Information is also at hand with regard to the method of payment of commission, the approximate proportion of loans made without commission, and other incidental questions.

On the basis of reports received from over 14,000 banks, or more than half the banks in the country, estimates have been made covering the total amount of farm mortgages held by the banks in each

State, the amount of such mortgages negotiated by banks or bank officials for other investors, the amount of short-time loans made by banks to farmers, and the total amount of deposits from farmers. Considerable supplementary material also has been obtained relating to the length of time for which money is loaned to farmers, and the privileges of prepayment and renewal granted by banks to borrowers.

Detailed information with regard to the financial and economic status of the farmers on the Minidoka and Truckee-Carson reclamation projects has been secured, partly by means of a comprehensive questionnaire and partly through direct field investigation. From the data at hand it is clear that capital is needed on these projects, especially for the purchase of stock to which to feed the alfalfa which is at present the principal crop.

Active field assistance has been rendered in perfecting an organization agreement for farm-mortgage credit improvement among the members of a cotton-growers' association in Arkansas. Under this agreement the association will indorse mortgage loans for its members, after securing the approval by its credit committee of the purpose of the loan, the security offered, and the method of payment, and on condition that a small percentage be paid by the borrower toward a reserve fund for the protection of the association.

A preliminary study has been made, partly by correspondence and partly by actual field investigations, of the agencies supplying cattle loans, including cattle-loan companies and different classes of banks in the central and far West.

An investigation of the conditions under which credit is extended to farmers by merchants and other dealers has been carried on in six selected localities, and Farmers' Bulletin No. 653, *How Farmers May Improve Their Personal Credit*, was published.

A study has been made of the kinds of legislation needed to facilitate the formation of farmers' organizations for agricultural credit, as well as of legislation affecting cooperative organizations in general. Active assistance in drafting such legislation has been given a number of States.

Considerable attention has been given to a study of the financial agencies in the United States supplying loans to farmers, particularly those agencies supplying loans on farm-mortgage security, and consideration has been given to proposed Federal legislation regarding rural credits.

#### INSURANCE.

Actual work in agricultural-insurance investigations was begun in February, 1915. A mailing list, comprising 95 per cent or more of the farmers' mutual fire-insurance companies in the United States, has been prepared. Replies to a comprehensive questionnaire have already been received from nearly 1,200 companies, or considerably more than one-half of the total number in the country. Field work involving a more detailed study of methods and problems has been conducted in Maryland, North Carolina, Virginia, and West Virginia. A model constitution and by-laws are in preparation. Preliminary steps have been taken for a study of farmers' mutual hail, windstorm, and live-stock insurance.



A preliminary study has been made of the outlook for the organization of farmers' mutual elevator-insurance companies in the grain-producing States of the Middle West. The methods of the New England factory mutuals have been studied in order to determine whether it will be practicable to apply the experience of these companies to the elevator-insurance problem and in some measure to agricultural insurance in general.

#### COMMUNICATION.

A preliminary study has been made of farmers' mutual telephone companies and some aid has been extended in this field.

Mr. C. W. Thompson is in charge of this project, with the assistance of Mr. V. N. Valgren and field collaborators.

#### SOCIAL AND EDUCATIONAL ACTIVITIES.

##### COMMUNITY SURVEYS AND FOLLOW-UP STUDIES.

Three social and economic surveys have been undertaken under this project. The first in Chilton County, Ala., was completed by June 30, 1914, and has been followed up by experimental studies in constructive organization work.

One need revealed in connection with this survey was that of a thorough educational campaign in the interests of health and sanitation, and this is now being conducted cooperatively by the county medical society, board of county commissioners, county school board, county demonstration agent, and Chilton County Fair Association. The United States Public Health Service has rendered advisory assistance. Another result secured was the appointment of a county nurse. This was accomplished through the cooperation of the board of county commissioners, county school board, county medical society, county demonstration agent, and three village improvement associations. A fund of \$1,500 was secured and the county nurse was appointed April 1, 1914. During the first year this nurse examined 1,500 school children for the usual physical defects and gave instructions to parents and teachers in regard to the necessity for treatment. These studies also led to the analyses of several hundred samples of water in different localities, revealing widespread sources of infection for typhoid fever. As a result, the services of the county health officer were secured in at least eight communities to vaccinate about 500 persons. In one community alone 64 persons were thus treated. Other communities and counties have followed this example.

Community clean-up days, athletic meets, and other recreational days have been held, a federation of local village and farmers' organizations has been formed, and there is now an organized demand in this county for an all-time health officer and for a domestic-science teacher. Finally the county has purchased a motion-picture machine for use in educational and recreational activities and in promoting interest in improving sanitary conditions throughout the county.

Two other surveys carried on in cooperation with this office are in progress, one in Albemarle County, Va., begun April 1, 1915, and one in Orange County, N. C., begun January 1, 1915. These will be followed up by such constructive organized effort as the facts gathered may suggest.

## COMMUNITY AND COUNTY FAIRS.

A study has been made with reference to methods of increasing the usefulness of community and county fairs as a means of stimulating community pride and as educational agencies. The success of community fairs directed by the office in an Alabama county a year ago led to the formulation of definite plans for 40 similar undertakings in the same county and in other parts of Alabama this year. As a result of new features inaugurated with the aid of this office in connection with the work of a county fair last year, desirable changes will be tried out in at least five neighboring county fairs this year.

## ORGANIZATION WORK AMONG FARM WOMEN.

A preliminary, first-hand review has been made of the existing state of organization among farm women in various parts of the country, attention being given to the objects and results of the associations. Observations also were made on the local plans for the development and extension of such organization and on the sentiment for it in different districts and agencies. From these observations it is intended to draw up a plan for the development of this work during the next fiscal year.

This project is under the direction of Mr. C. W. Thompson, with Mr. J. S. Moran, Mr. L. E. Truesdell, and Miss Anne M. Evans as assistants.

## INVESTIGATION AND DEMONSTRATION OF COTTON STANDARDS AND COTTON TESTING.

As outlined in the general statement at the beginning of this report, much of the cotton work now done in this office was begun in the Bureau of Plant Industry. It was not separated into the present existing projects until comparatively recent dates. The work will be reported under these project headings, however, and will be so conducted hereafter.

## INVESTIGATION AND DEMONSTRATION OF COTTON STANDARDS.

Previous to the promulgation on December 15, 1914, of the new official standards of the United States a large number of the permissive grades issued under authority of the appropriation act of 1909 and subsequent acts were used by county demonstration agents of the Department of Agriculture at primary markets in the South in demonstrating how they can be utilized by the farmer in the marketing of his cotton. Additional sets representing the new standards have been prepared for a continuation of this demonstration during the coming year. The use of the official standards has also been demonstrated in a practical way in the work conducted in Edgecombe County, N. C., in the cooperative grading work at Atkins, Ark., and in the market survey grading previously reported under Cotton Handling and Marketing.

During the autumn of 1914 the new standards were demonstrated by representatives of the department in Liverpool, Bremen, Havre,

and other European markets, and it is hoped that this work will assist toward securing universal adoption of these standards by foreign exchanges. Copies of the official cotton standards of the United States have been sent to purchasers in the following countries: Canada, China, England, France, Germany, Holland, India, and Japan. Types of cotton have been collected from representative members of the trade in order to obtain the commercial idea as to the lower lengths of staple, three-fourths to seven-eighths of an inch. These samples have been carefully compared and studied with a view to formulating a standard that could be used by the Department of Agriculture in the determination of disputes, and a tentative standard was agreed upon.

Samples of the various grades and classes of tinged and stained cotton have been collected from the exchanges and large spot markets in different sections of the cotton belt. In order that a comprehensive standard for color might be established, an effort has been made to represent the grade characteristics of each section. Owing to the scarcity of tinged and stained cotton during the past season, however, it has been found impossible to establish a standard of color with such care and precision as would be necessary in order to facilitate cotton transactions in the best way. It was decided therefore not to attempt immediately to establish and formulate standards of color, but for the convenience of the department in passing on disputes to issue three boxes of type representing the lowest quality of cotton deliverable under the fifth subdivision of section 5 of the United States cotton futures act; namely, one each for Low middling blue tinged, Low middling yellow tinged, and Middling yellow stained. In order to facilitate in the exchanges the work of classification of cotton proposed for tender on contracts, the department furnished to each of the future exchanges and to the bona fide spot markets designated by the Secretary of Agriculture a set of these types. This was done with the distinct understanding that they were not issued as standards, but only for temporary use as guides, and with a further agreement that the types should be returned to the department when the standard was officially established.

Toward the end of the cotton season (May and June, 1915), when tinges and stains were more plentiful, about 100 bales covering the necessary qualities were purchased. The preparation of standards for color is now in progress as follows: Yellow tinged and light yellow tinged of the grades of Good Middling, Strict Middling, Middling, Strict Low Middling, and Low Middling; blue tinged of the grade of Middling, Strict Low Middling, and Low Middling; and stained cotton of the grade of Middling.

A representative of the department has been stationed at Mesa, Ariz., during the past harvesting season to study the grade characteristics of the Egyptian-Arizona cotton and to formulate grade standards in cooperation with the Salt River Valley Cotton Growers' Association. As a result of this work five tentative standards have been prepared: Medium, Choice, Standard, Extra, and Fancy. The cooperative associations through which most of this cotton is marketed have been furnished copies, and in order to maintain the uniformity of these tentative standards five copies of each have been



stored in vacuum. The final standards for this Arizona-Egyptian cotton are to be promulgated later, provided the tentative forms as now prepared indicate proper relative qualities when submitted to the spinning tests now in progress.

The rules and regulations issued under the cotton futures act provide that the standards that are used by the exchanges and spot markets shall be inspected from time to time. When it is found that they do not accord with the original standards, the owners are notified to that effect and the certifications are canceled. If the owners so wish, they will be returned to Washington for correction. On June 30, 13 firms had sent back 36 boxes, which were corrected and returned to the firms.

This work is conducted under the direct supervision of the Chief of the Office of Markets and Rural Organization, assisted by Messrs. Fred Taylor, D. E. Earle, W. R. Meadows, H. B. Parker, H. C. Slade, W. C. Neal, D. C. Griffith, and Hal Brown.

#### COTTON TESTING.

Previous work on this subject has been reported by the Bureau of Plant Industry.

The probability of the discontinuance of the permissive standards promulgated previous to the passage of the United States cotton futures act made it inadvisable to continue spinning tests during the last fiscal year on the basis of the old standards. The results of the tests made on those standards have been prepared in manuscript and may be issued in permanent form if conditions seem to justify it.

Cotton representing the tentative standards of the five grades of Arizona-Egyptian cotton, prepared in connection with investigational work on the commercial handling of cotton under the cotton handling and marketing project (representing the five grade standards of the 1913 crop) has been tested during the present fiscal year at the textile school, New Bedford, Mass. These tests are now being repeated on the same tentative standards, using 1914 crop cotton, to determine whether the relative values of the product made from these grades coincide with the grades as prepared. The present status of these tests seems to indicate that the Arizona-Egyptian cotton compares very favorably with Sea Island and Egyptian, both as to waste percentage and tensile strength.

Bales representing the various grades of the official cotton standards of the United States, promulgated December 15, 1914, according to the provisions of the cotton futures act and superseding the old permissive standards, have been bought from the Coastal Plain of the Atlantic States, the Piedmont section, and the Coastal Plain and Black Land sections of Texas and Oklahoma, with a view to making tests to determine the waste, tensile strength, and bleaching qualities of the different grades and classes to determine their relative spinning values.

This work is conducted under the direct supervision of the Chief of the Office. A supervisory committee consisting of Messrs. Fred Taylor, W. R. Meadows, and D. E. Earle renders assistance, together with Messrs. W. S. Dean, T. C. Adams, and J. J. W. Cooper.

## ENFORCEMENT OF THE UNITED STATES COTTON FUTURES ACT.

By order of the Secretary of Agriculture the administration of the cotton futures act was delegated to the Office of Markets and Rural Organization. Close cooperation is maintained with the Office of the Solicitor, where all legal points are determined.

All of the following projects have been inaugurated in connection with the enforcement of this act, in order to render its administration as effective as possible.

### INVESTIGATION OF FUTURE AND SPOT MARKETS FOR COTTON.

The work under this project has developed along three clear-cut lines, as indicated below:

#### INVESTIGATION OF FUTURE EXCHANGES.

A careful investigation has been made of the future exchanges at New York and New Orleans, both of which have adopted the form of contract prescribed by section 5 of the cotton futures act. The cotton exchanges at Liverpool, Bremen, and Havre have been visited and their methods of business examined carefully. The investigation of the American exchanges has been conducted from three standpoints.

The rules and regulations of the exchanges have been studied in detail, and their methods of business have been compared with the requirements of the cotton futures act. Suggestions as to changes in their regulations have been made from time to time wherever a conflict was apparent between any rule and the act. These suggestions in most cases have been accepted by the exchanges, while in other cases action on the part of the exchanges is still pending. Frequent visits have been made to future exchanges in order to gather first-hand information as to their internal organization and to explain to the members of the exchanges any points on which assistance was needed.

Owing to the importance of New Orleans as a cotton market, and owing to the fact that its exchange determines commercial differences on the basis of its own actual spot transactions, it has seemed advisable to station an agent of this office in that city. The duties of this agent are (a) to examine all sales of spot cotton made in the New Orleans market, and thus insure the accuracy of published quotations for spot cotton; and (b) to keep himself fully posted as to the general local conditions, that he may be able to advise this office at all times on matters about which inquiry may be made.

#### INVESTIGATION AND DESIGNATION OF SPOT MARKETS.

An investigation of the spot markets was made during the last fiscal year by representatives of the office in cities of the United States where cotton customarily is bought and sold in large quantities. After carefully considering the conditions in each market and after securing the promise of cooperation from the respective exchanges, certain cities were selected and designated as "bona fide

spot markets" for cotton, under the terms of the cotton futures act. The cooperation of other markets was secured without such designation being given. It is expected that the investigation of the spot markets of the South will continue and that others may be named in the course of time as "bona fide spot markets." Such designations not only assist in the proper enforcement of the cotton futures act, but at the same time they add to the reliability of local quotations, serving therefore to improve the facilities for marketing cotton in many parts of the South. During the last fiscal year 13 cities were named as bona fide spot markets. Under the cotton futures act the quotations of five or more of these designated markets are required to be used as the basis for obtaining commercial differences for the settlement of future contracts on exchanges. The cities that have been so designated are as follows, all of them being used at the present time except Charleston and Mobile:

Augusta, Ga.  
Boston, Mass.  
Charleston, S. C.  
Dallas, Tex.  
Galveston, Tex.  
Houston, Tex.  
Little Rock, Ark.

Memphis, Tenn.  
Mobile, Ala.  
Montgomery, Ala.  
New Orleans, La.  
Norfolk, Va.  
Savannah, Ga.

#### MARKET QUOTATIONS.

The third field of work under this project is that of securing market quotations. Daily quotations are obtained by wire from each of the designated bona fide spot markets. These quotations are tabulated and the differences in price between Middling and the other grades are calculated and averaged. These average differences are considered the true "commercial differences" which shall be used in the settlement of future contracts for cotton. The differences established under this project are not promulgated as "official," but are used as checks against the commercial differences which the future exchanges must ascertain and establish on their own responsibility.

Mr. W. R. Meadows has exercised direct supervision over the work of this project.

#### DETERMINATION OF DISPUTES.

The provision made in the United States cotton futures act for the hearing of disputes as to the grade, quality, or length of staple of cotton arising between the persons making and receiving tenders of cotton under section 5 contracts became operative February 18, 1915. The Rules and Regulations of the Secretary of Agriculture made pursuant to the provisions of the act bearing on disputes were issued in tentative form shortly prior to November 1, 1914, and in final form on February 11, 1915.

Prior to the date on which the first dispute was received attention was given to the drafting of suggested forms to be used by the trade in submitting disputes to the department. These forms were published later in Service and Regulatory Announcement No. 4. Forms were also drafted for the use of this office in the handling of disputes.

Seven examiners were detailed to pass on most of the cotton in disputes received during the month of March. The purpose was to



have the examiners work together in order to develop uniform judgment in so far as possible. Later they were divided into examining squads of three.

While the number of bales referred to this department during the month of March were comparatively few a great deal of time was lost in determining the disputes, because the trade was not thoroughly conversant with the act and the Rules and Regulations of the Secretary of Agriculture. This necessitated much correspondence calling attention to missing samples, wrong tag numbers, and other errors in the papers filed in connection with the disputes.

In passing on disputes received in March the examiners found that some of the cotton was untenderable under the provisions of the United States cotton futures act, thus necessitating the return of such bales by the receiver to the deliverer, who had to replace such bales to complete the contract. This brought to light a new phase of the situation which had not been taken into consideration, that is, the fact that disputes might arise as to the grade or length of staple or quality of cotton delivered in replacement. As no provision had been made in the rules and regulations for the filing with this department of such disputes, tentative rules were made allowing one replacement dispute and fixing a schedule of costs to cover it pending the action of the Secretary of Agriculture on this question.

Among those received during March were certain disputes that arose in settlement of contracts entered into prior to February 18, 1915. Apparently these did not come under the jurisdiction of the department under the act, although the deliveries were made subsequently to that date, but such disputes were heard when both parties to the contract requested that they be settled by the Secretary of Agriculture. This action was taken after communicating with the parties in the disputes to the effect that the provisions of the United States cotton futures act were not operative as to contracts mentioned in section 3 entered into prior to February 18, 1915, and that it was the opinion of this department that findings of the Secretary of Agriculture, if made, would not be accepted in the courts of the United States as *prima facie* evidence of the facts therein stated. As the parties still wished to know the conclusions upon the disputes they had submitted, the questions were considered and the conclusions thereon were made known for the information and guidance of the parties. In such cases the parties at interest were furnished only with an examiner's memorandum of conclusions and no formal findings of the Secretary of Agriculture were issued.

Between March 15 and March 31, 1915, approximately 2,500 bales of cotton were submitted to the department. These disputes were not settled, however, until about the middle of April, owing to the amount of time consumed in securing from the parties at interest absolutely correct samples, papers, etc. Very few disputes arose in April. During the month of May over 35,000 bales of cotton were involved in disputes. In spite of the number of disputes, the work progressed smoothly, with good results. This was partly due to the fact that the trade in New York had become more accustomed to the workings of the act, and it had profited by the advice previously given. Also practically all were filed by stipulation instead of com-

plaint and answer, as was the case in March, thereby saving the time required for a respondent's answer.

On account of the replacement disputes which arose from cotton found untenderable by this department in disputes determined during the month of May, the work continued to be very heavy during the month of June.

*Recapitulation of disputes handled to June 30, 1915.*

			Bales.
During March	there were	35 disputes on March deliveries, involving	2,504
During April	there were	7 disputes on March deliveries, involving	715
During April	there were	2 replacement disputes on March deliveries, involving	148
During May	there were	3 replacement disputes on March deliveries, involving	74
During May	there were	4 disputes on April deliveries, involving	413
During May	there were	367 disputes on May deliveries, involving	35,229
During June	there were	261 replacement disputes on May deliveries, involving	3,240
During June	there were	24 disputes on May deliveries, involving	2,450
To June 30	there were	703 disputes, involving	44,773

The amount of costs assessed against the parties at interest for the hearing of the disputes up to June 30, 1915, amounted to \$15,668.80, which was turned into the Treasury as miscellaneous receipts, in accordance with the provisions of the United States cotton-futures act.

The work under this project is being supervised by the chief, assisted by Mr. W. R. Meadows.

The findings in the disputes are prepared by Messrs. T. B. Mills, jr., G. R. Argo, R. A. Freret, E. T. Chassignac, and A. M. Agelasto.

**PREPARATION AND DISTRIBUTION OF THE OFFICIAL COTTON STANDARDS OF THE UNITED STATES.**

The appropriation act for the United States Department of Agriculture for the fiscal year ending June 30, 1909, contained an item which enabled the department to undertake investigations in the standardization of cotton. Subsequent appropriation acts provided for the continuation and extension of the work on cotton standardization and the distribution by sale of copies of the permissive standards, prepared and approved by the department under the act referred to. These standards were permissive and no concerted effort was made to secure their adoption by the trade. On subsequent examination it was found that the standards for the low grades were not typical of a sufficient proportion of these grades as produced in the cotton belt to make them of the greatest value. They were modified, therefore, to accord more accurately with the true requirements.

The new official standards were provided for by the United States cotton-futures act approved August 18, 1914. On December 15, 1914, after the work herein described, the Secretary of Agriculture established and promulgated these modified standards for the nine grades of cotton: Middling Fair, Strict Good Middling, Good Middling, Strict Middling, Middling, Strict Low Middling, Low Middling, Strict Good Ordinary, and Good Ordinary.

## PREPARATION OF THE NEW OFFICIAL COTTON STANDARDS.

During the fall months of 1914 the department secured the temporary services of some of the classers of the New York and New Orleans Cotton Exchange Classification Committees to assist its technical force in perfecting a standard which would meet the valid objections to the old permissive standards and yet avoid the introduction of anything which might be classed as tinged or spotted cotton. The result was a set of standards believed to represent the white cotton of an average American crop more closely than any standards previously prepared.

The new standards were tested by grading a large number of samples which previously had been classed on the old standards by the same set of men, and it was found that about 12 per cent more of this cotton could be graded on the basis of the new official cotton standards than by the old permissive grades.

As previously reported, representatives of the Department of Agriculture were sent abroad to the exchanges at Bremen, Liverpool, and Havre for the purpose of demonstrating the new standards and consulting with these exchanges as to advantages to be gained by their adoption of the official cotton standards for grade, thus making it a universal standard, which is so much desired by the cotton trade.

Owing to the nature of their business, the two great future exchanges—those at New York and New Orleans—adopted the standards for all transactions subsequent to February 18, 1915. The use of the standard by the spot cotton exchanges in the United States is optional; but 21 of such exchanges or similar organizations have adopted the standard and are making their quotations thereon. The following list contains all exchanges that had adopted the standard up to June 30, 1915:

New York Cotton Exchange.	Charleston Cotton Exchange.
New Orleans Cotton Exchange.	Memphis Cotton Exchange.
Montgomery Cotton Exchange.	Galveston Cotton Exchange.
Selma Cotton Exchange.	Texas Cotton Buyers' Association,
Little Rock Board of Trade.	Waco.
Mobile Cotton Exchange.	Waco Cotton Exchange.
Augusta Cotton Exchange.	Houston Cotton Exchange.
Savannah Cotton Exchange.	Dallas Cotton Exchange.
New England Cotton Buyers' Association,	Paris Cotton Exchange.
Boston.	San Antonio Cotton Exchange.
Fall River Cotton Buyers' Association.	Norfolk and Portsmouth Cotton Exchange,
St. Louis Cotton Exchange.	Norfolk.
Vicksburg Cotton Exchange.	
Oklahoma State Cotton Association,	
Oklahoma City.	

## DISTRIBUTION OF NEW OFFICIAL COTTON STANDARDS.

Three hundred and eighty sets of the official cotton standards had been prepared and distributed on June 30, 1915, to the various exchanges, spot-market dealers, merchants, cotton mills, agricultural colleges, and textile schools in the United States, and 12 sets had been shipped to foreign countries. Twenty-five sets of the standards have been prepared and stored in vacuum for future reference. These are to be opened whenever it is necessary to do so



in order to check by comparison the accuracy and uniformity of the present standards.

About 200 sets of the old permissive standards have been returned to the department since the new standards were promulgated. These permissive standards have been examined in connection with the length of service of each set, with a view to gaining a more definite idea as to the length of time that a set of standards in use may be expected to represent truly the original standards.

This work has been under the immediate supervision of the chief, assisted by Messrs. Fred Taylor, D. E. Earle, D. C. Griffith, William S. Dean, J. G. Martin, O. J. McConnell, H. B. Parker, W. C. Neal, Hal Brown, H. C. Slade, R. L. Francis, R. L. Crittenden, L. W. Kellner, T. C. Adams, J. J. W. Cooper, R. L. Kause, H. B. Richardson, C. E. Coburn, C. E. Killingsworth, R. V. Hellams, B. M. Botto, M. L. Rice, C. E. Atkinson, G. H. Anderson, and S. W. Shear.

#### DEPARTMENTAL COOPERATION.

The nature of the work of the Office of Market and Rural Organization makes cooperation with the other units of the department imperative. Incidental mention has been made of such cooperation, but it is desired here to make more specific acknowledgment of affiliation with the Bureau of Animal Industry in work on the transporting and marketing of live stock, in cooperative organization, parcel post, and other lines of work; with the Dairy Division of that bureau in the investigations relating to the marketing of dairy products; with the Bureau of Plant Industry in cotton, grades and standards, transportation, storage, and grain work; with the Bureau of Crop Estimates in many lines, including market surveys; with the States Relations Service in all extension work; with the Bureau of Chemistry in certain work now under way and in other lines under contemplation; and with the Office of the Solicitor, which has been of great assistance to this office in compiling and digesting many State and National laws, in rendering decisions and in giving legal advice on many questions.

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